An Outlook and Overview for Wind Power in the U.S. and Virginia

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Virginia Coastal Energy Research Consortium

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What we will examine

- Energy profile in Virginia
- Wind power technology
- Federal perspective and activities
- State perspective and activities
- Efforts in Virginia to facilitate wind power development

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- ***Energy profile in Virginia***
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Pre-industrial energy profile in Virginia

- "Muscles, Firewood, Windpower, and Waterpower…" (http://www.virginiaplaces.org/energy)
  - The human muscles of Native Americans were the energy source for hunting, fishing, and farming in Virginia for thousands of years
  - Firewood was a fundamental source of energy for colonial manufacturing started by the Europeans

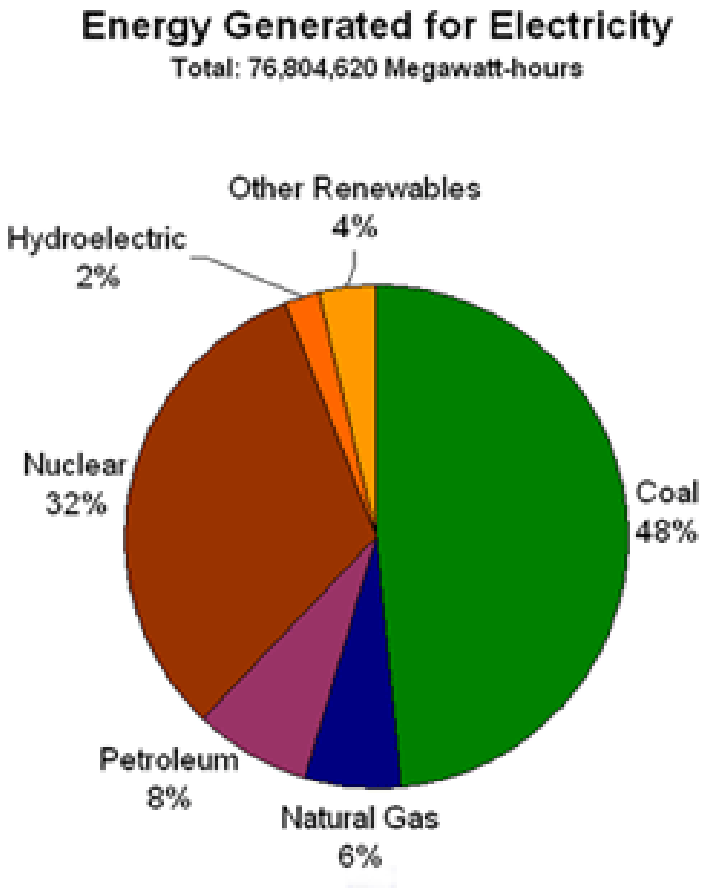
Pre-industrial energy profile in Virginia

- "Muscles, Firewood, Windpower, and Waterpower…" (http://www.virginiaplaces.org/energy)
  - Early European visitors and colonists relied upon windpower for transportation - sailing was far easier than paddling or rowing
  - European colonists used waterpower, obtaining the mechanical energy in falling water to turn wheels that ground grain, sawed wood, or stamped iron

Present-day energy profile in Virginia

- The energy consumed for generation of electricity within Virginia accounts for 45% of primary energy production
- Despite advances in sustainable/renewable energy technologies, less than 1.5% of primary energy production is attributable to renewable sources, and only 4% of energy generated for electricity is attributable to non-hydro renewable sources
- The advent of coal and other fossil fuels in the late 19th century relegated sustainable energy to secondary status

Present-day energy profile in Virginia (http://www.energy.vt.edu/vept/)



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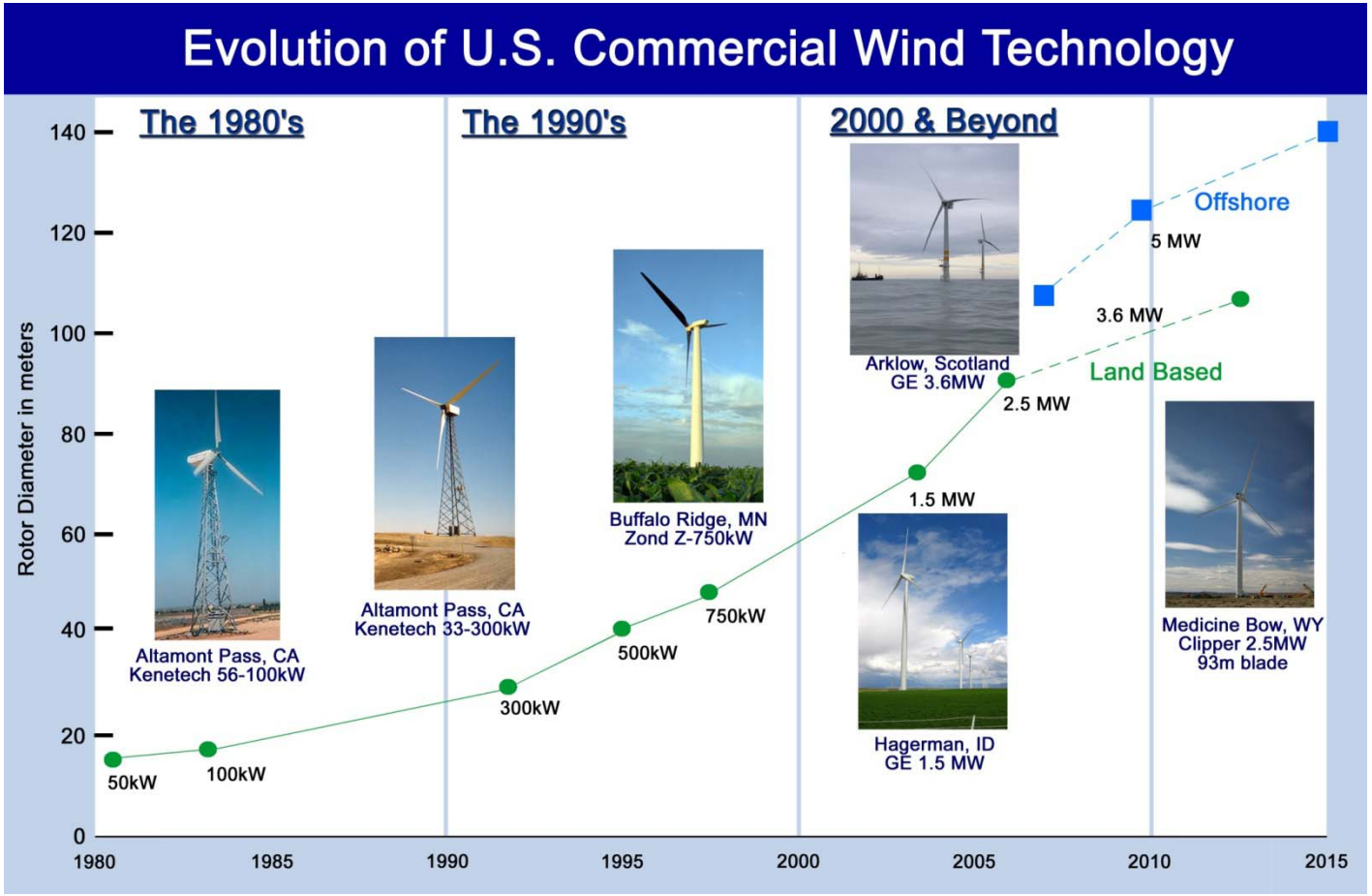
- Energy profile in Virginia
- ***Technology is a primary driver of wind power development/deployment in the U.S.***
- Federal perspective and activities
- State perspective and activities
- Efforts in Virginia to facilitate wind power development

Wind power has been one of the fastest developing commercial energy technologies since 1980



What is driving the interest in wind power?

- National and state electricity needs
- Environmental concerns with fossil, nuclear
- CO_2 and climate change
- Renewable Portfolio/Energy Standards
- Cost competitiveness with coal
- Virginia has some attractive wind resources
- National goals

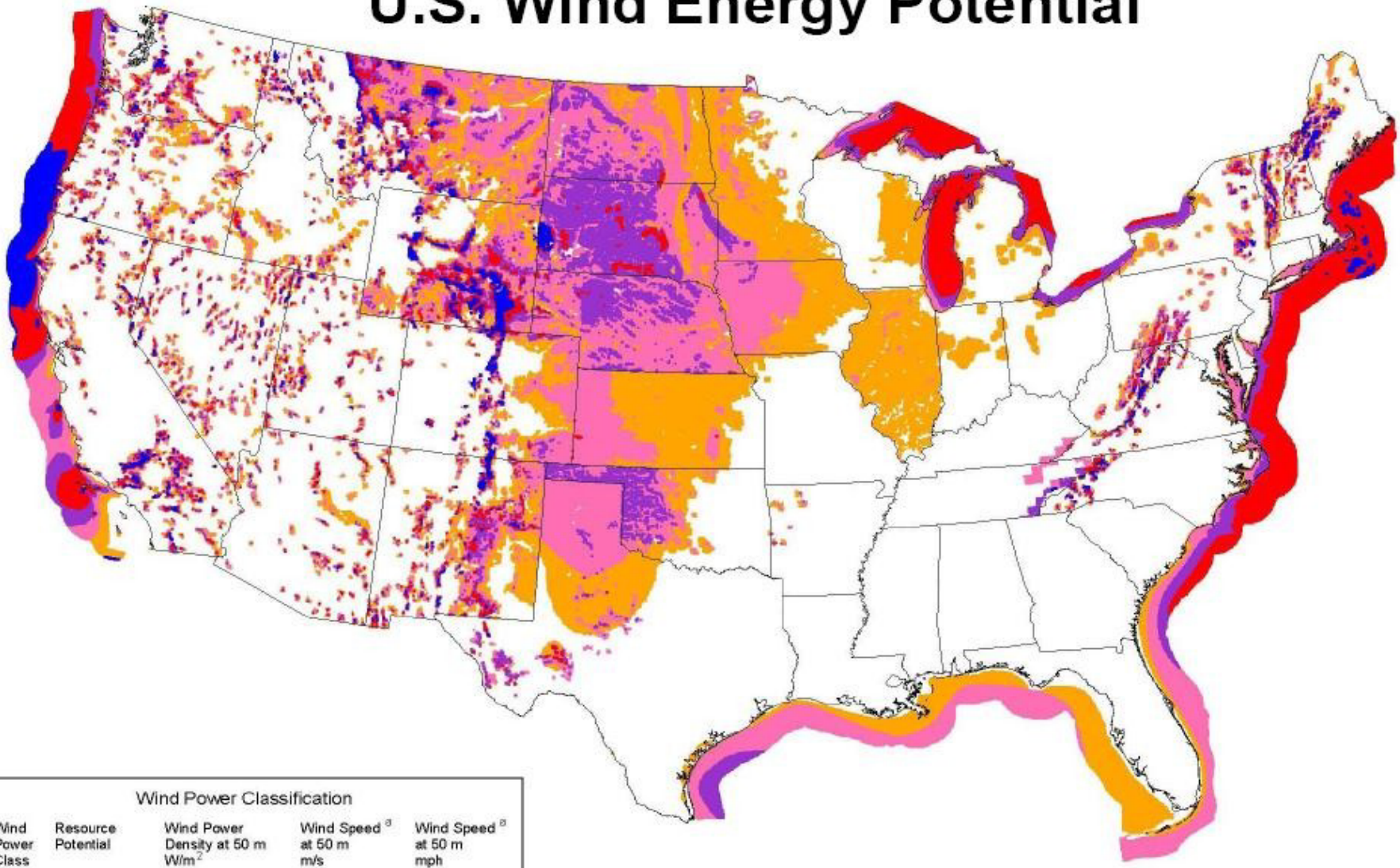
Advantages & Disadvantages associated with wind power

- No emissions
- Stable & predictable electricity costs
- Installs quickly
- Does not require water
- Can be dismantled at end of life comparatively easily
- Intermittent (but reliable)
- Good wind resources are not everywhere
- Site-specific environmental impacts must be very carefully assessed

Environmental benefits

- No SO_X or NO_X
- No particulates
- No mercury
- No CO_2
- No water

U.S. Wind Energy Potential



Wind Power Classification

Wind Power Class	Resource Potential	Wind Power Density at 50 m W/m^2	Wind Speed [a] at 50 m m/s	Wind Speed [a] at 50 m mph
3	Fair	300 - 400	6.4 - 7.0	14.3 - 15.7
4	Good	400 - 500	7.0 - 7.5	15.7 - 16.8
5	Excellent	500 - 600	7.5 - 8.0	16.8 - 17.9
6	Outstanding	600 - 800	8.0 - 8.8	17.9 - 19.7
7	Superb	800 - 1600	8.8 - 11.1	19.7 - 24.8

[a] Wind speeds are based on a Weibull k value of 2.0

This map shows the wind resource data used by the WinDS model in Oct. 2006. It is a combination of high resolution and low resolution datasets produced by NREL and other organizations. The data has been screened to eliminate areas unlikely to be developed onshore.

U.S. Department of Energy
National Renewable Energy Laboratory

NREL

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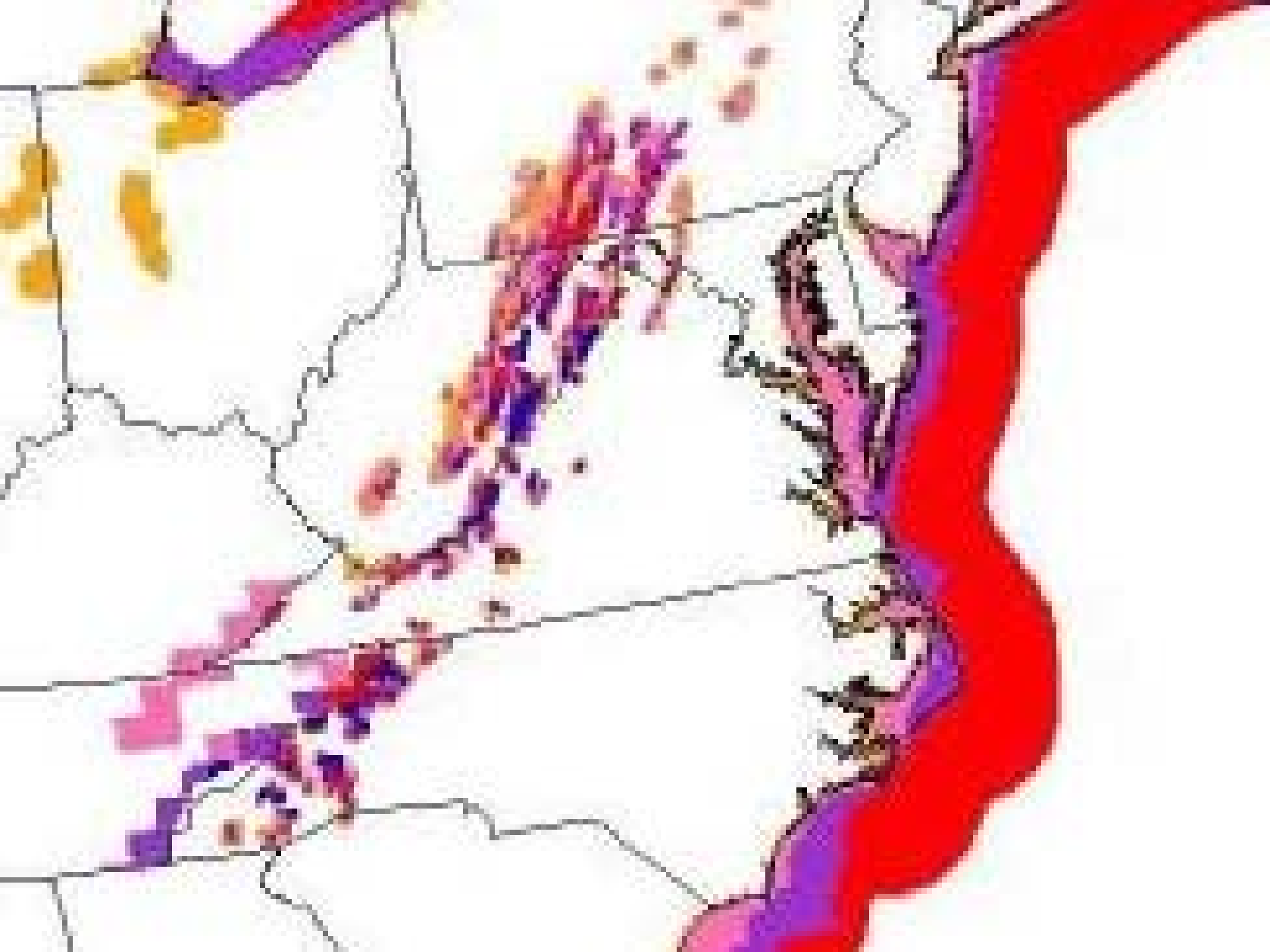
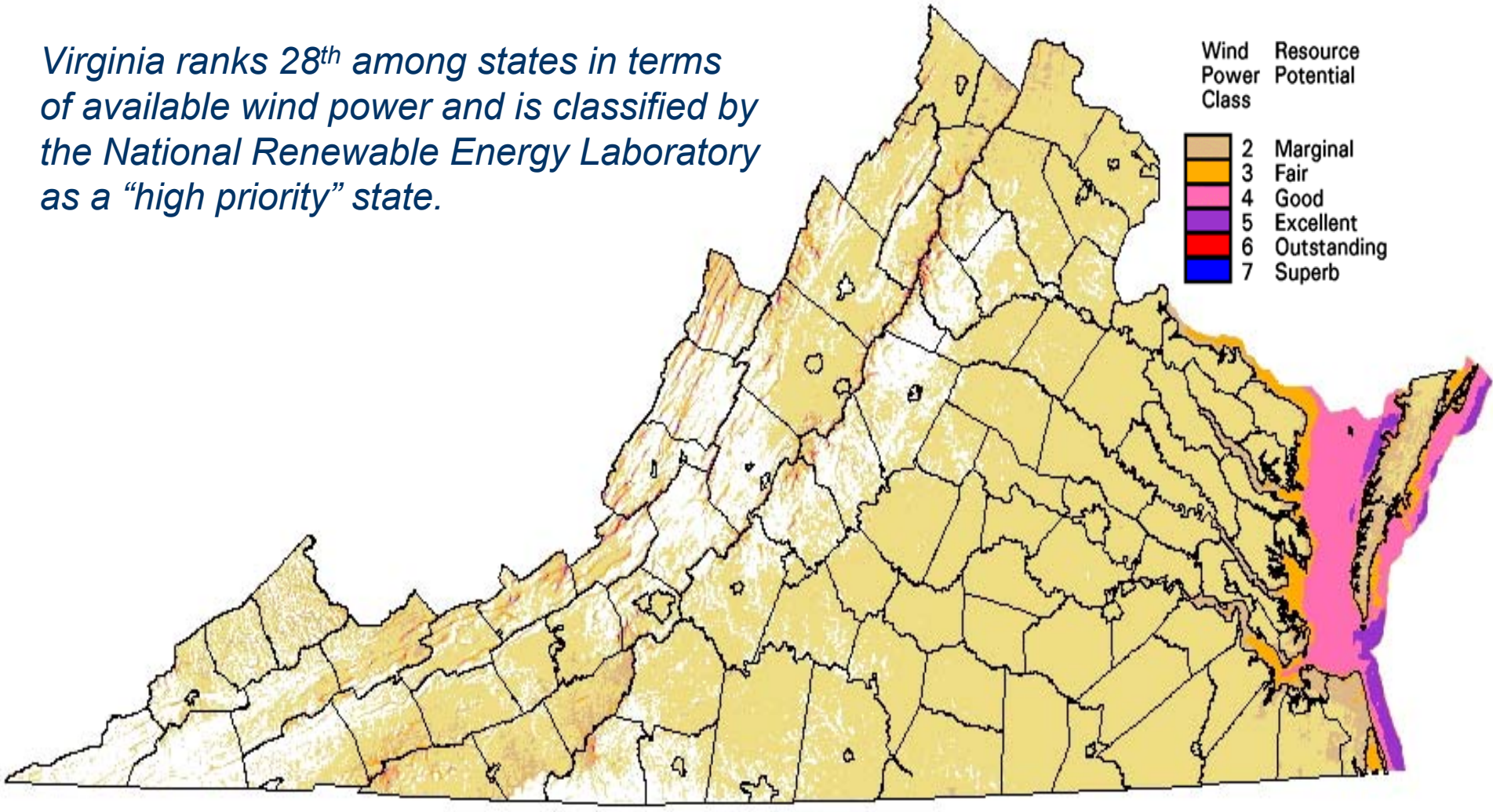
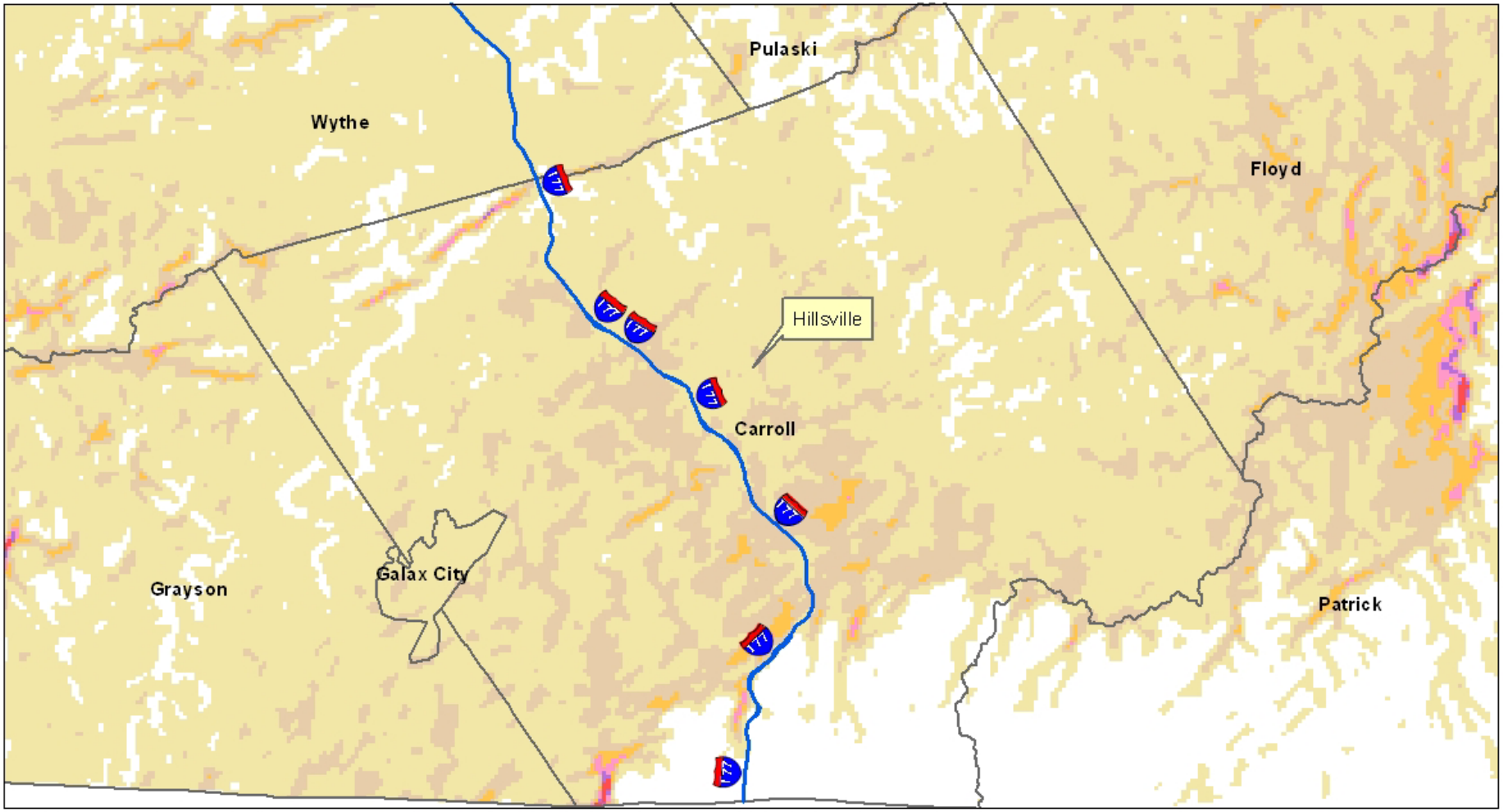


Wind resources in Virginia

Virginia ranks 28th among states in terms of available wind power and is classified by the National Renewable Energy Laboratory as a "high priority" state.





Source: Integrated Science and Technology Program at James Madison University and the National Renewable Energy Laboratory (2009)

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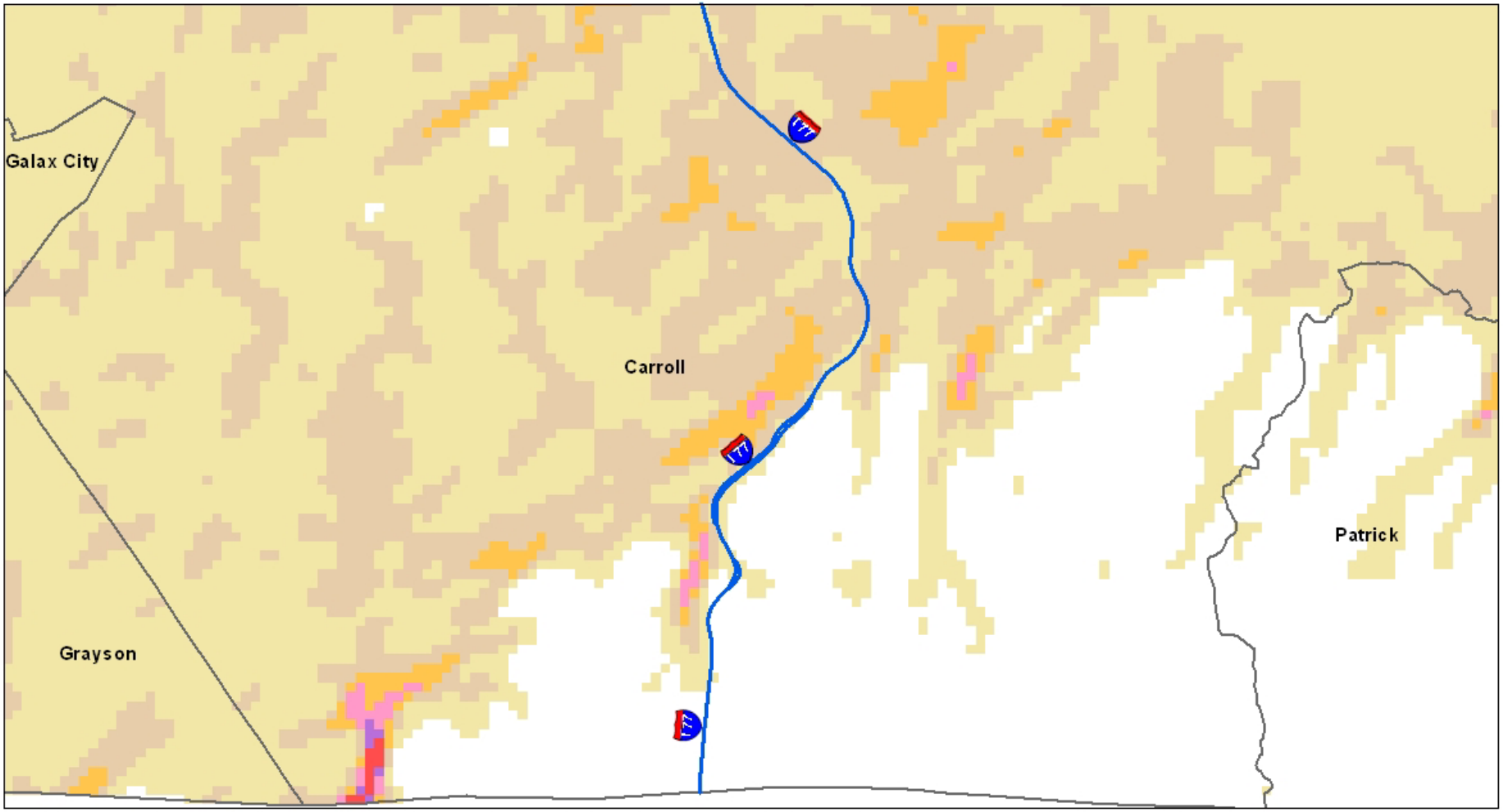
2	Marginal	200 - 300	5.9 - 6.7	13.2 - 15.0
3	Fair	300 - 400	6.7 - 7.4	15.0 - 16.6
4	Good	400 - 500	7.4 - 7.9	16.6 - 17.7
5	Excellent	500 - 600	7.9 - 8.4	17.7 - 18.8
6	Outstanding	600 - 800	8.4 - 9.3	18.8 - 20.8
7	Superb	> 800	> 9.3	> 20.8

[a] Wind speeds are based on a Weibull k of 2.0 at 1500 m elevation.

Counties
Interstate

N
W E
S

0 2.5 5 10 15 20 Miles



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Counties
Interstate

N
W
E
S

0 1 2 4 6 8 Miles

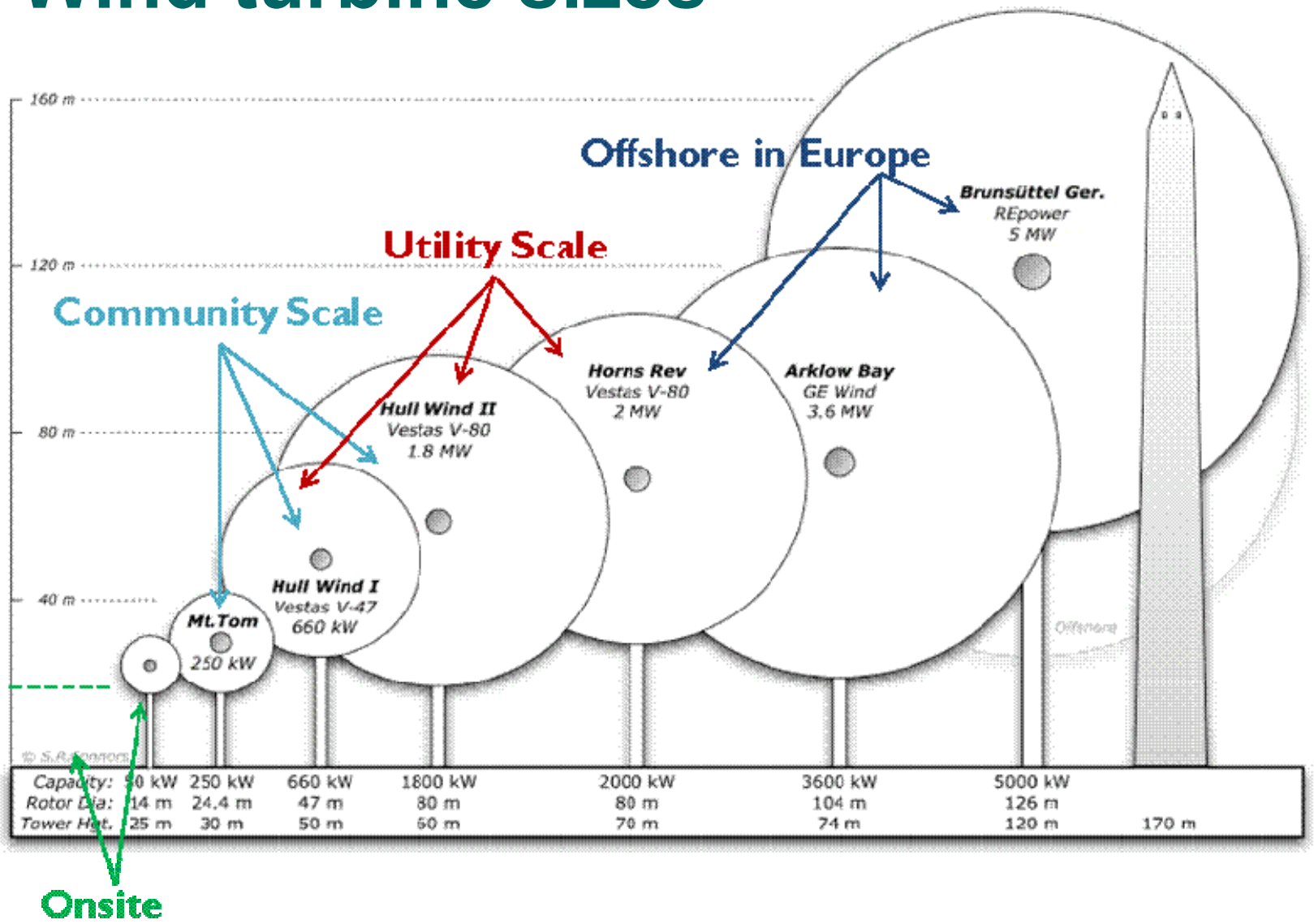
Wind turbine size and terminology

- The Industry: defines by generating capacity
  - Small wind < 100 kW, Large wind > 100 kW
- The Public: defines by physical size
  - How big/tall is it? How many turbines?
- Net-metered
- Grid-connected, grid-tie
- Nameplate capacity: rated maximum output
- Capacity factor: estimates energy output

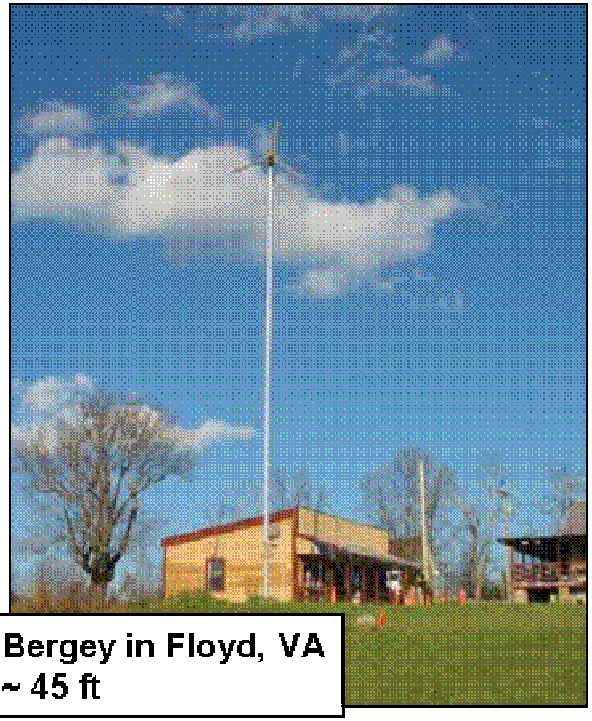
Wind turbine size and terminology

Category	Nameplate Capacity	Description
Onsite	≤ 10 kW (residential) ≤ 500 KW (commercial)	These systems are small, either stand-alone or net metered, and would probably involve only 1 turbine.
Community	≤ 10 MW	Community-scale projects are typically either net metered or connected to the local distribution network, but could be connected to transmission. These projects are typically owned by and serve the community. They would probably involve less than 5 turbines. In the Midwest, there are community wind systems that are also "utility scale" using our definition.
Utility	< 50 MW	Industrial-scale wind power projects are most often developed by a company that either will own or sell the project for the purpose of realizing a return on their investment.
	≥ 50 MW	An industrial-scale wind power project equal to or greater than 50 MW nameplate capacity is subject to the full approval process by the Commonwealth's State Corporation Commission.

Wind turbine sizes



Onsite systems

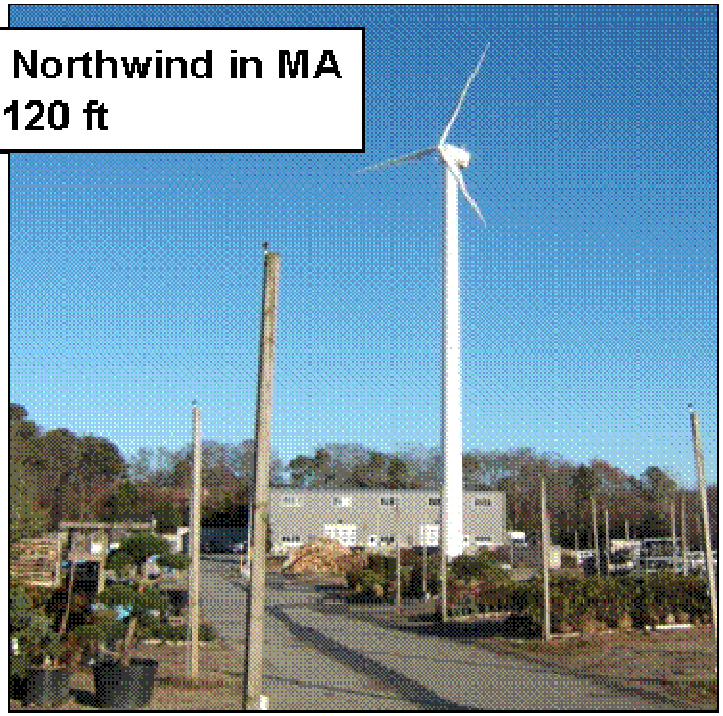


A 1-kW Bergey in Floyd, VA
Height: ~ 45 ft

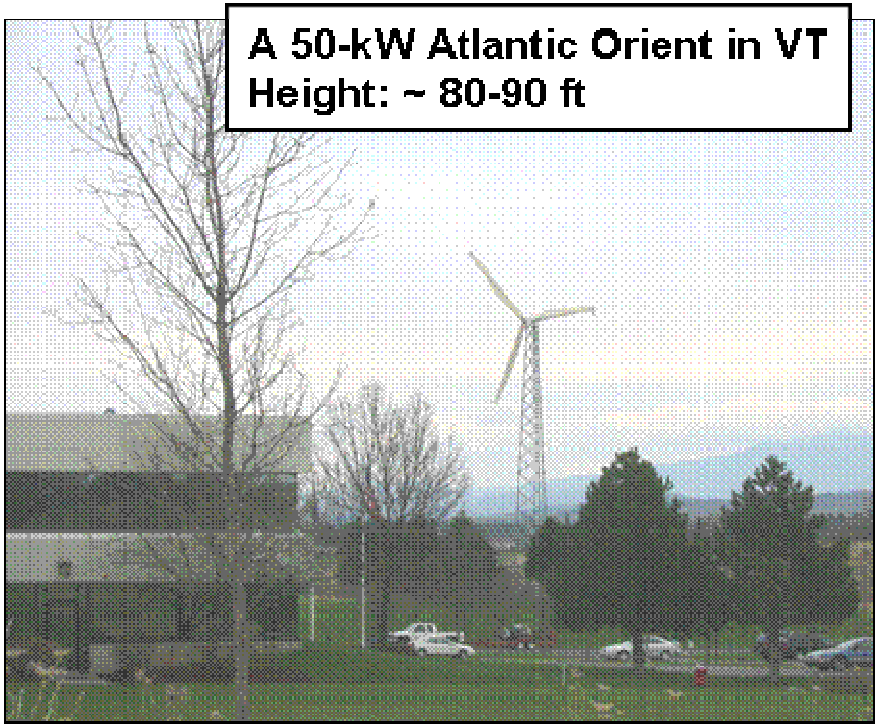
A 20-kW Westwind in Ireland
Height: ~ 60 ft

Community wind power

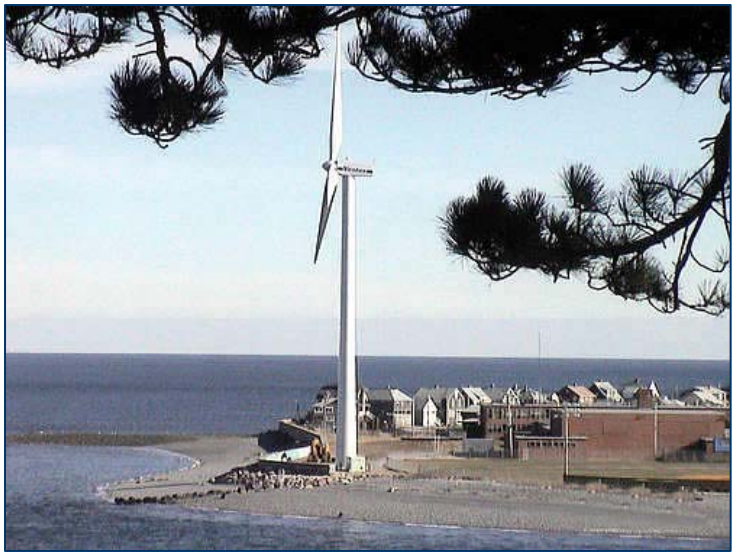
A 100-kW Northwind in MA
Height: ~ 120 ft



A 50-kW Atlantic Orient in VT
Height: ~ 80-90 ft



Community wind power



A 660-kW community system in Hull, MA, less than 10 miles from Boston.

Utility-scale wind power

Bear Creek Wind Power Project near Wilkes-Barre, PA, as seen from the PA Turnpike. These are 2.0 MW Gamesa Turbines.

Turbine Size and Wind Class: Putting it all together

- Basic prerequisites for community and commercial wind energy development:
  - Availability of a good wind resource
  - Topography
  - Price/cost of electricity

Wind Class	Potential for Wind Development
Class 1 or 2	• Marginal for onsite • Unsuitable to marginal for community-scale • Unsuitable for utility-scale
Class 3	• Appropriate for onsite • Marginal to appropriate for community-scale • Generally unsuitable for utility-scale
Class 4	• Appropriate for onsite or community-scale • Marginal for utility-scale
Class 5+	• Appropriate for all scales

Turbine Size and Wind Class: Putting it all together

- Setbacks/fall zones/spacing varies from ½ to 1 acre per turbine for onsite, and 1-4 acres per turbine for community
- For utility, varies from 2 acres per megawatt nameplate capacity (if in series) to 25 acres (if arrayed 2-dimensionally)
- A linear mile of ridgeline holds 6-12 turbines depending on size of the turbine

Considerations during construction

- Roads
- Forest clearing
- Slopes
- Surface streams

Considerations for safety & nuisance

- Safety setbacks
- Ice throws
- Sound
- Shadow flicker
- Electromagnetic interference
- Height and turbine capacity factor
- Visual impact

Key environmental & other considerations

- Wildlife
- Designated wilderness
- Sensitive habitats
- Forest fragmentation
- Scenic views
- Cultural and historic resources
- Recreation

The proliferation of wind power in the U.S. continues . . .

After reaching 1,000 MW of wind energy in 1985, it took more than a decade for wind to reach the 2,000-MW mark in 1999. Since then, installed capacity has grown to 26,274 MW (as of January 31, 2009). Today, U.S. wind energy installations produce enough electricity on a typical day to power the equivalent of more than 6.5 million homes.

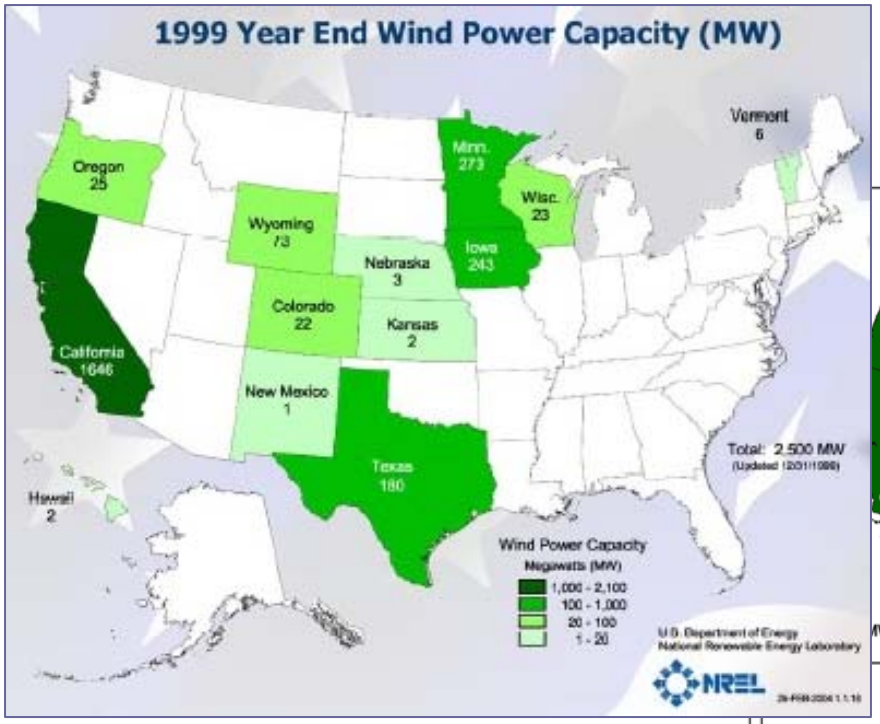
U.S. Department of Energy – Wind Powering America

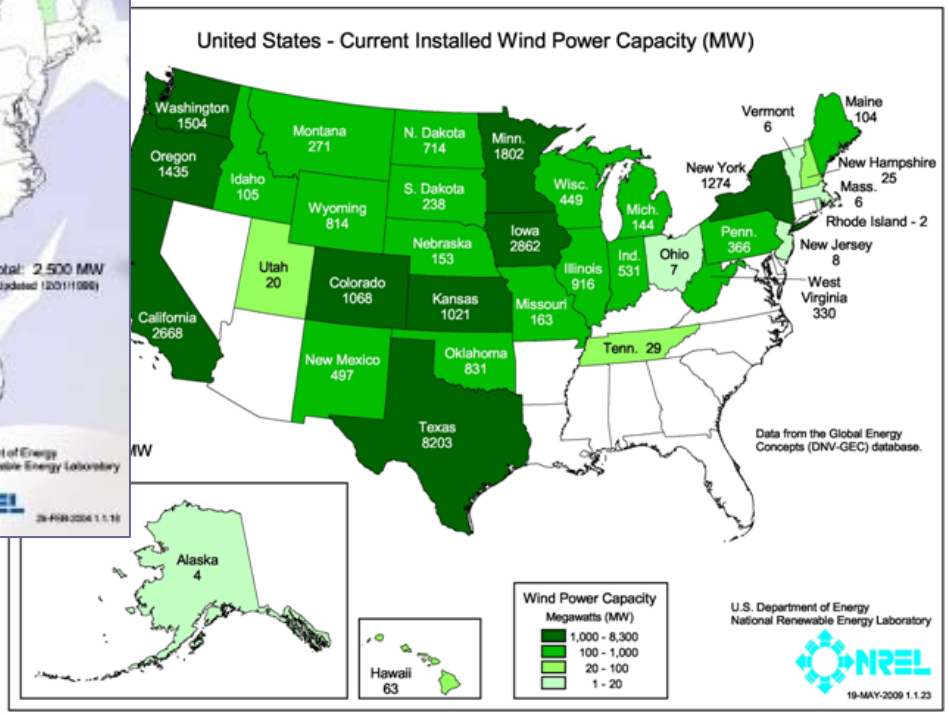
The proliferation of wind power in the U.S. continues . . .

For the fourth consecutive year, wind power was second only to natural gas in terms of new capacity added. The new wind projects completed in 2008 account for about 42% of the entire new power-producing capacity added nationally last year, according to initial estimates, and will avoid nearly 44 million tons of carbon emissions, the equivalent of taking over 7 million cars off of the road.

American Wind Energy Association

Installed Wind Capacities (1999–2009)





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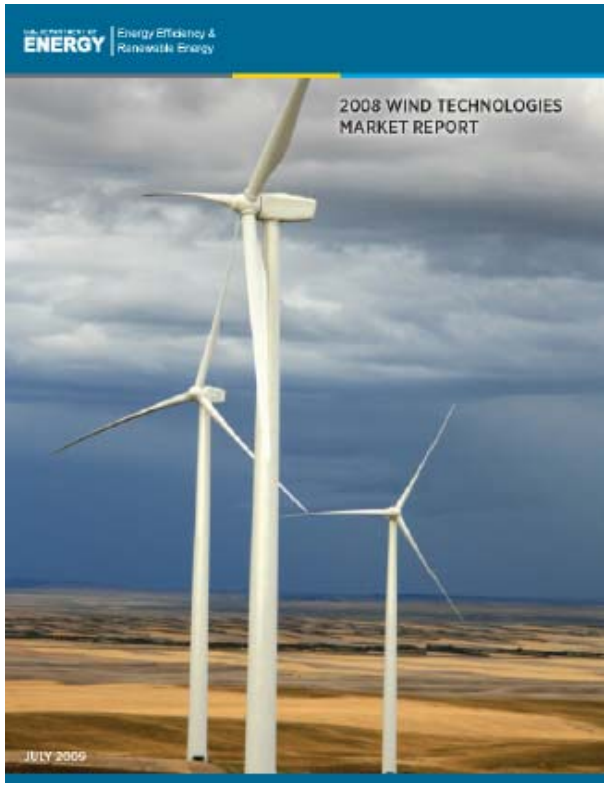
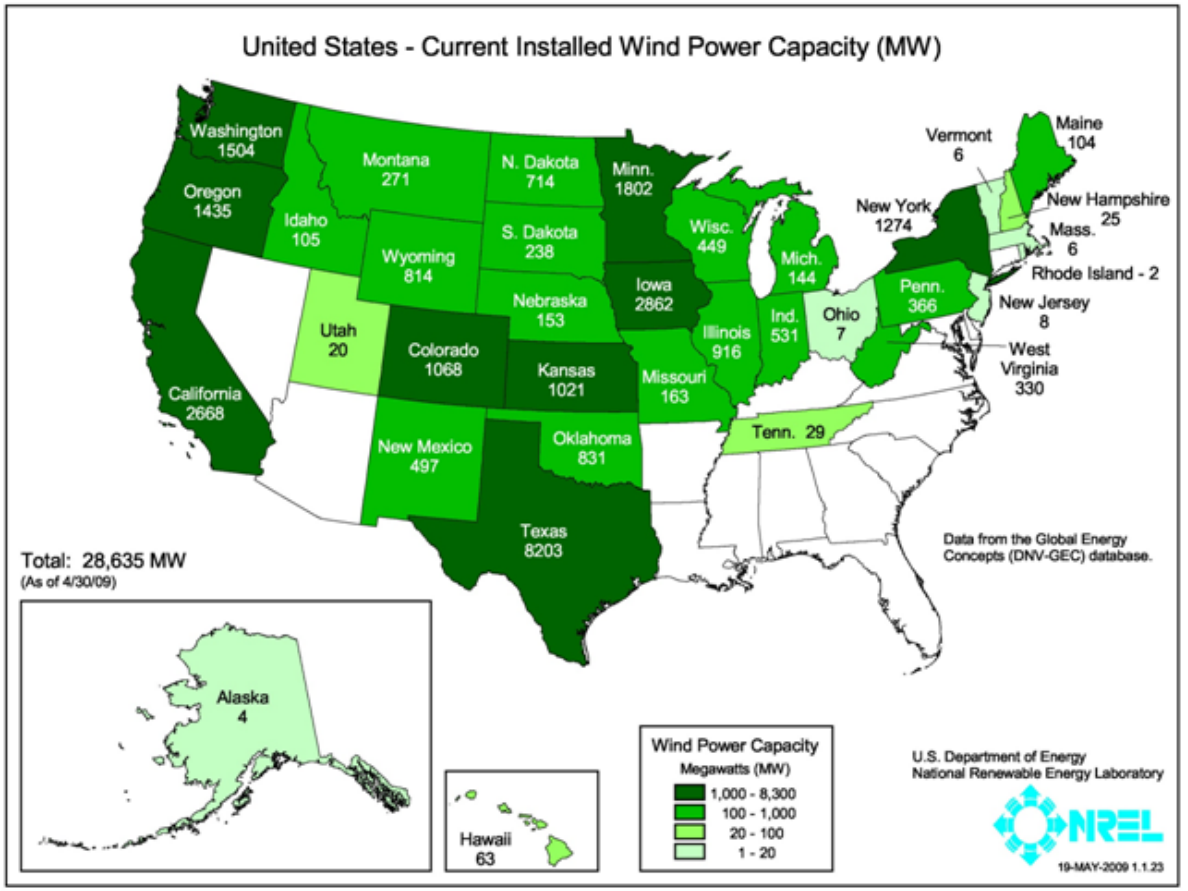
DOE Wind Energy Program

http://www1.eere.energy.gov/windandhydro/

Industry Landscape:
Wind power has spread to majority of U.S.

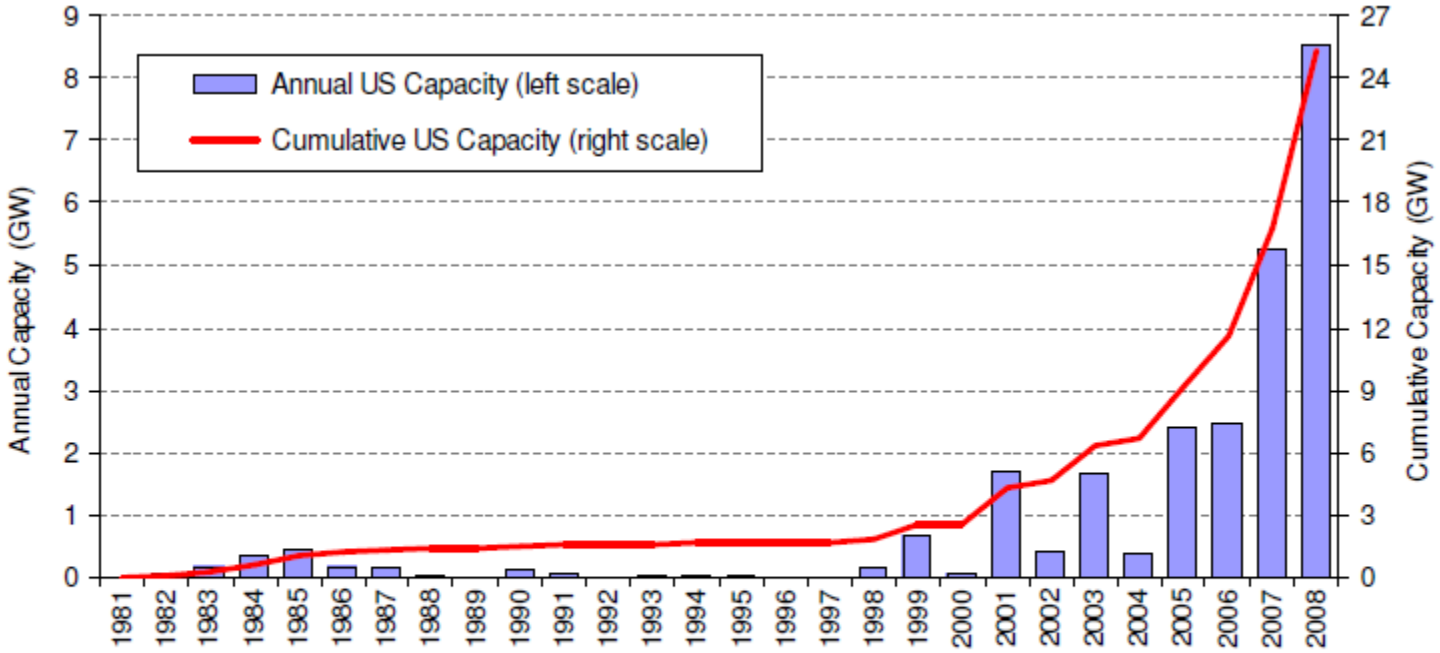
- Over 25,000 MW installed in the U.S. (last quarter of 2008)
- nearing 2% of U.S. energy production
- >122,000 MW installed worldwide
- 38 states now have wind power
- nearly 3,000 GW of wind in transmission interconnection queues





Sources: NREL, AWEA

U.S. Wind Power Capacity Up >50% in 2008



Record year for new U.S. wind capacity:

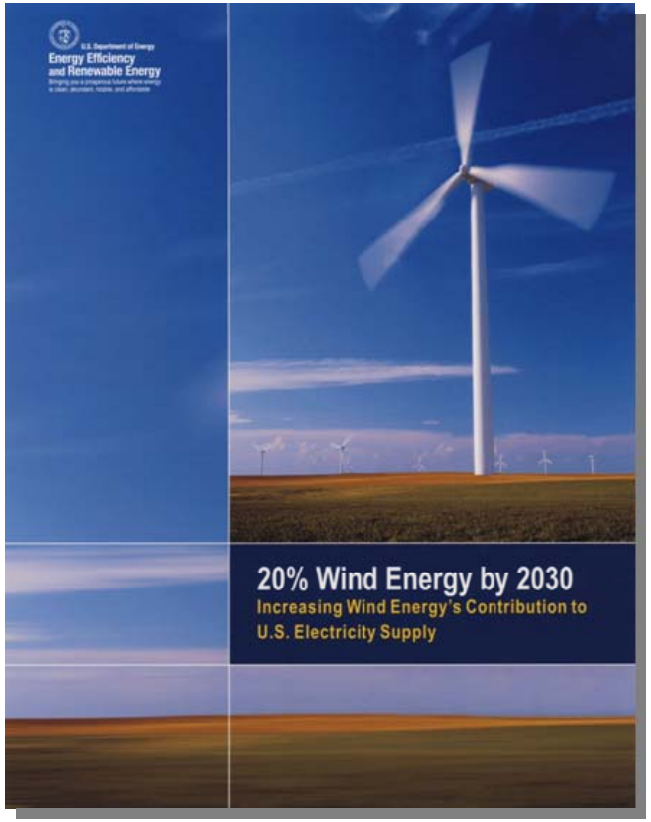
- 8,558 MW of wind added in 2008, bringing total to 25,369 MW
- Roughly $16.4 billion in 2008 project investment

20% U.S. Electricity from Wind by 2030

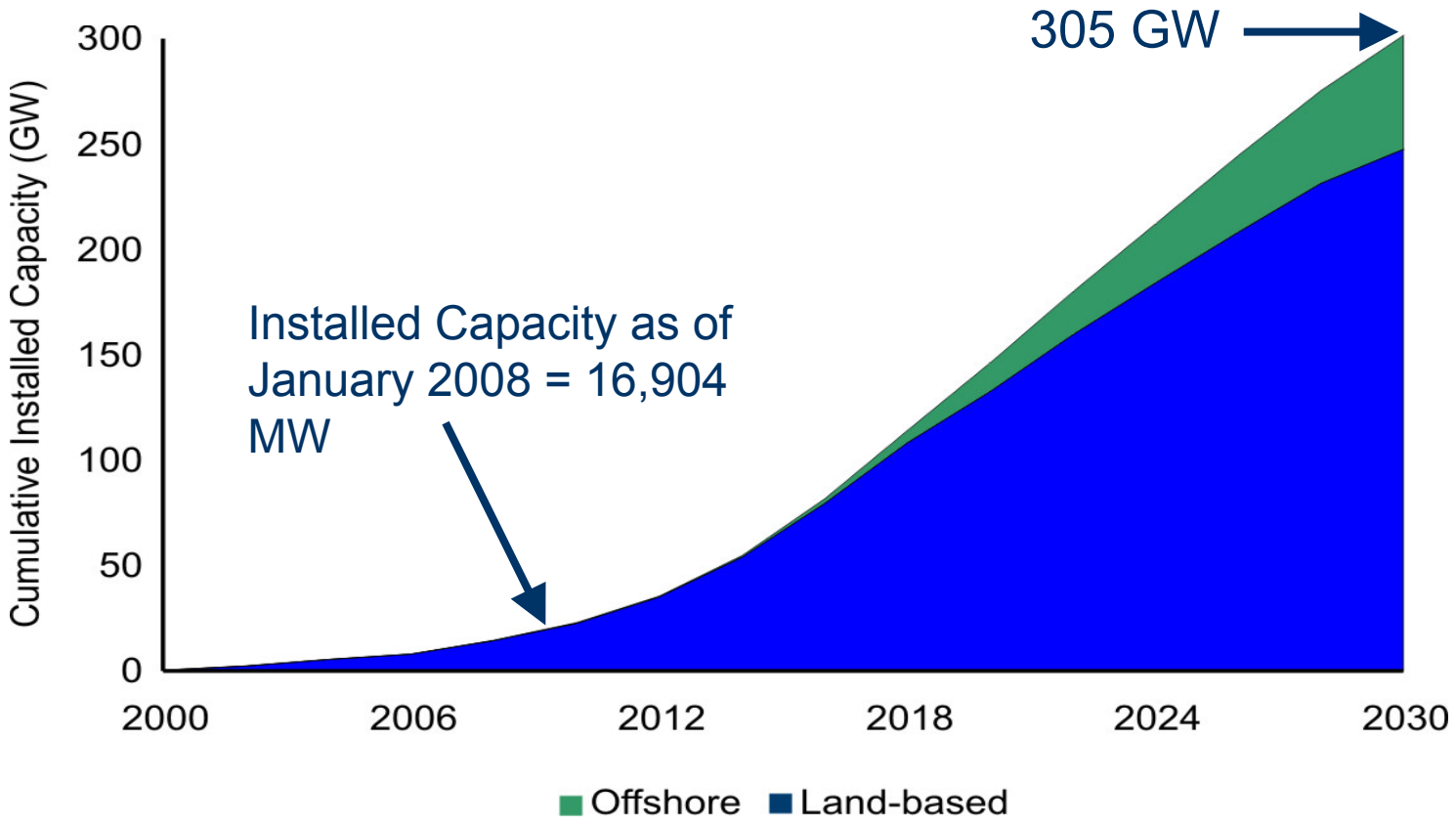
Hallmark report released in May clarifies pathway to major contribution from wind energy in the U.S.

Lead the nation's efforts to improve **wind energy technology** through public/private partnerships that enhance domestic economic benefit from wind power development and to coordinate with stakeholders on activities that **address barriers to wind energy use** through:

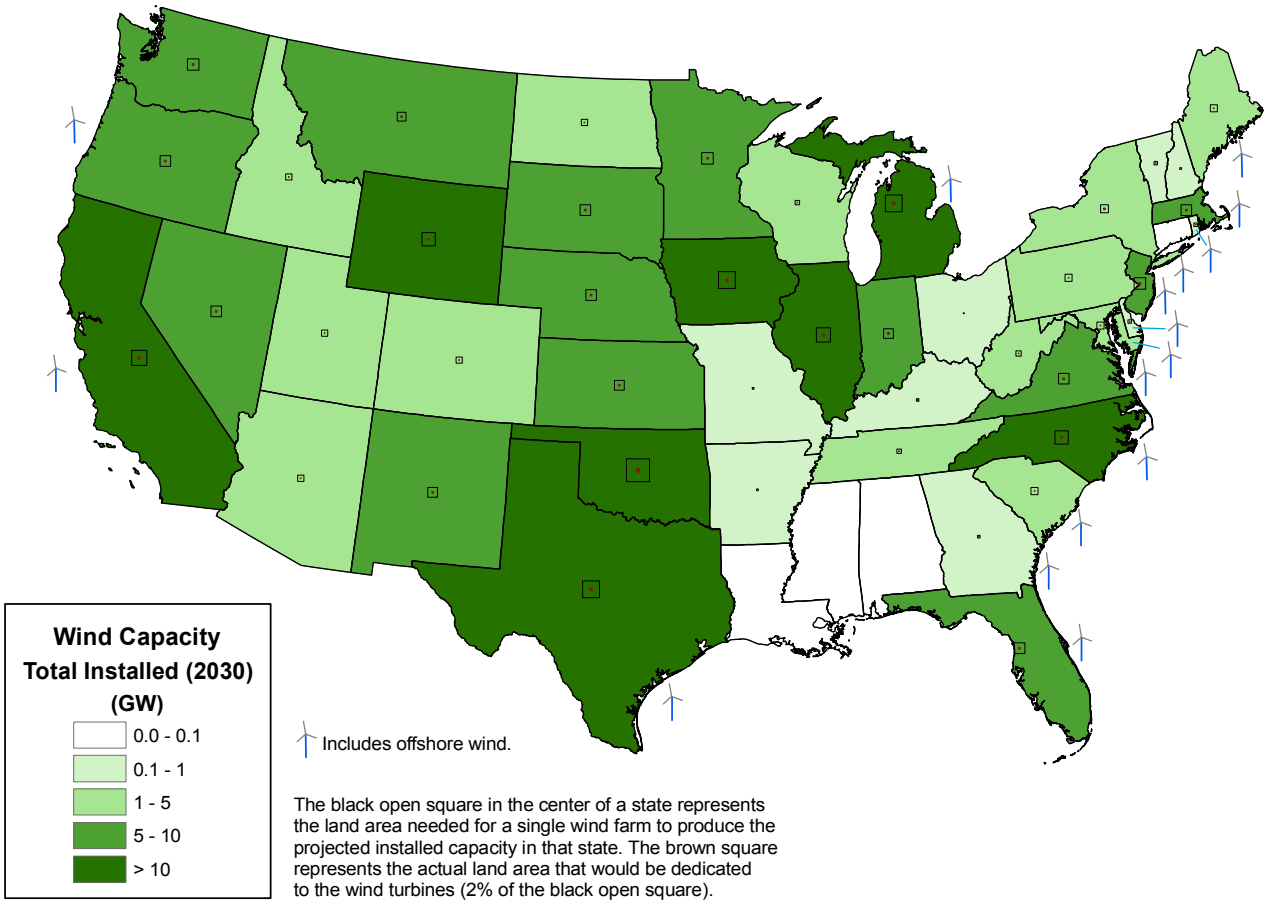
- Technology Improvement
  - Addressing technical and financial risks
- Ramping up Domestic Manufacturing
- Transmission and Integration
  - Transforming utility operations and transmission planning
- Addressing Siting and Environmental Challenges
- Wind Power Market and Application Development



20% Wind Scenario



46 States Would Have Substantial Wind Development by 2030



The black open square in the center of a state represents the land area needed for a single wind farm to produce the projected installed capacity in that state. The brown square represents the actual land area that would be dedicated to the wind turbines (2% of the black open square).

The report addresses the major barriers to increased development of wind energy and offers recommendations.

Many states have established new policies and developed programs to promote increased deployment of wind energy, subsequently a broad range of commercial entities have responded by diversifying their energy portfolios to include wind and are taking advantage of the range of opportunities that wind energy presents.

The Obama administration has signaled its intent to increase support from the federal government significantly for wind and other clean energy technologies.

An overview of the “20% Wind Energy by 2030” report is presented with special consideration for the benefits and opportunities that apply to commercial facilities.

Economic Benefits, Carbon Dioxide (CO_2) Emissions Reductions, and Water Conservation Benefits from 1,000 Megawatts (MW) of New Wind Power in Virginia

Wind power is one of the fastest growing forms of new power generation in the United States. Industry growth in 2007 was an astounding 45%. New wind power installations constituted 35% of all new electric power installations. This growth is the result of many drivers, including increased economic competitiveness and favorable state policies such as Renewable Portfolio Standards. However, new wind power installations provide more than cost-competitive electricity. Wind power brings economic development to rural regions, reduces water consumption in the electric power sector, and reduces greenhouse gas emissions by displacing fossil fuels.

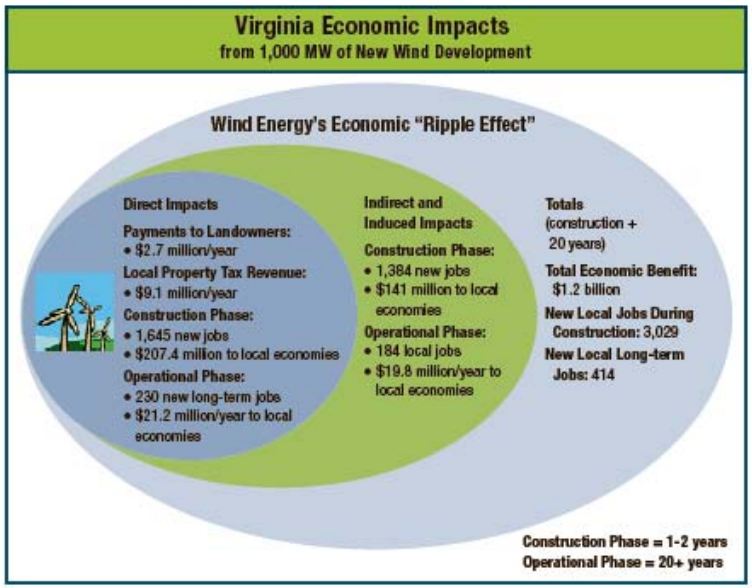
The U.S. Department of Energy's Wind Powering America Program is committed to educating state-level policy makers and other stakeholders about the economic, CO_2 emissions, and water conservation impacts of wind power. This analysis highlights the expected impacts of 1000 MW of wind power in Virginia. Although construction and operation of 1000 MW of wind power is a significant effort, six states have already reached the 1000-MW mark. We forecast the cumulative economic benefits from 1000 MW of development in Virginia to be **$1.2 billion**, annual CO_2 reductions are estimated at **3.0 million tons**, and annual water savings are **1,600 million gallons**.

Economic Benefits

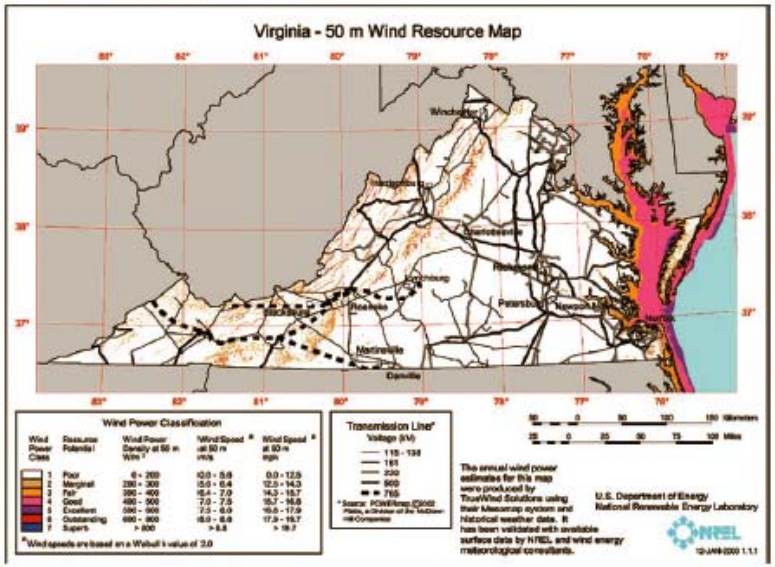
Building and operating 1000 MW of wind power requires a significant investment. But this investment will generate substantial direct, indirect, and induced economic benefits for Virginia. Direct benefits include jobs, land-lease payments, and increased tax revenues. Indirect benefits include benefits to businesses that support the wind farm. Induced benefits result from additional spending on goods and services in the area surrounding the development.

Direct impacts result from investment in the planning, development, and operation of new wind facilities. Beneficiaries include landowners, construction workers, O&M staff, turbine manufacturers, and project managers. Indirect impacts reflect payments made to businesses that support the wind facility and include banks financing the project, component suppliers, and manufacturers of equipment used to install and maintain the facility. Induced benefits result from increased spending by direct and indirect beneficiaries. Examples include increased business to restaurants, retail establishments, and child care providers.

Drivers of economic benefits include the use of local construction companies, the presence of in-state component suppliers, local wage structures, local property tax structures, and operation and maintenance (O&M) expenditures. The projected benefits for Virginia could be greatly increased by the development of a local wind supply, installation, and maintenance industry within the state.



Distribution of Wind Resources in Virginia



Methodology

The data for economic analysis are primarily from interviews with state-specific contacts, including developers, power plant operators, contractors, mining and gas associations, and state property tax assessors or administrators. When interviews were not possible, information was obtained from public Web resources, state tax reports, and federal databases for current power plants. Cumulative impacts are estimated for construction and 20 years of operations. Economic impacts are 2007 constant dollars and estimated by application of the National Renewable Energy Laboratory's (NREL's) Jobs and Economic Development Impacts (JEDI) model. Carbon estimates apply 2004 non-baseload CO_2 emissions rates (EPA eGRID2006 Version 2.1, April 2007). Water savings are calculated based on consumption rates for various generating technologies.

Data Inputs	
Construction Cost	$1,980/kW
Operations and Maintenance	$24.70/kW
Property Tax	$9,897/MW
Landowner Lease Payments	$2,667/MW/year

Consumption rates were compiled by Western Resource Advocates and calculated from EIA form 767 data and EPRI publications. Consumption rates are applied to the NERC region generation mix as determined from EIA form 960/920 (2006).

CO_2 Emissions and Water Conservation Benefits

In 2004, the average Virginia resident emitted approximately 6.2 tons of CO_2 as a result of electricity consumption. As a state, Virginia ranked 36th in per capita electricity sector CO_2 emissions. CO_2 emissions are increasingly important factors as state and federal government consider policies regarding climate change while drought in the Southeast has underscored the relevance of freshwater supply issues outside of the arid and semi-arid regions of the United States.

Developing wind power in Virginia will result in CO_2 emissions reductions and water savings. Choosing to build wind results in CO_2 reductions from fewer new coal plants built and less natural gas consumption. In addition, both fossil- and nuclear-based electricity generation consume large amounts of water. Wind power reduces our reliance on increasingly vital freshwater resources.

Annual Impacts in Virginia from 1000 MW of New Wind Power	
Water Savings	CO_2 Savings
1,600 million gallons	3.0 million tons

For more information, contact:

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Suzanne Tegen, Suzanne_Tegen@nrel.gov
Wind Powering America
National Renewable Energy Laboratory
1617 Cole Blvd. MS3811
Golden, CO 80401

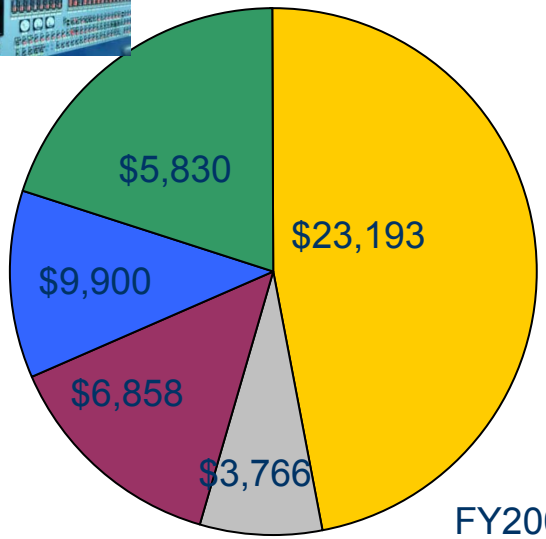
DOE investment to achieve 20% wind penetration

12% Renewable Systems Interconnection

Wind Interconnection: Improved grid analysis, wind forecasting and remove other integration barriers to wind deployment

47% Large Wind Technologies

Technology, Manufacturing: Improve reliability and operability, increase capacity factors, and reduce cost of large wind turbine technologies



FY2008

20% RSI Supplemental

Transmission: Support transmission planning and enable expanded grid integration of variable wind resource

14% Wind Powering America

Markets, Siting, Environmental: Work with national stakeholders to move wind technology into the power generation market

8% Distributed Wind

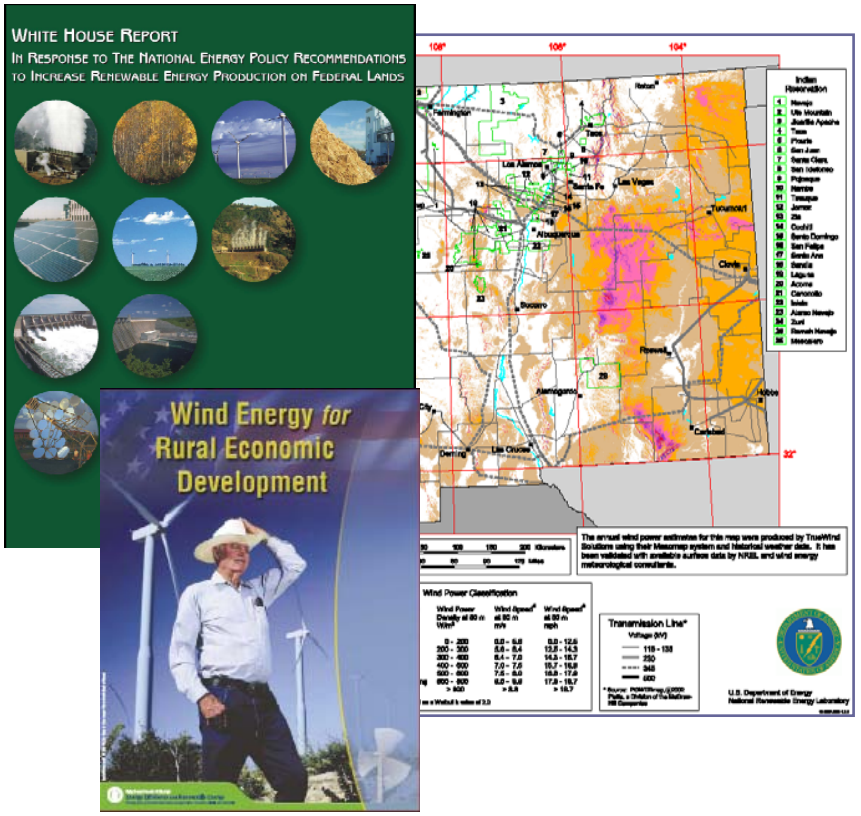
Technology: Improve the performance, cost, reliability & availability of small wind and medium scale wind turbines

Program Initiatives:
Wind Powering America

Goal: Reduce barriers to project development to accelerate deployment of wind energy

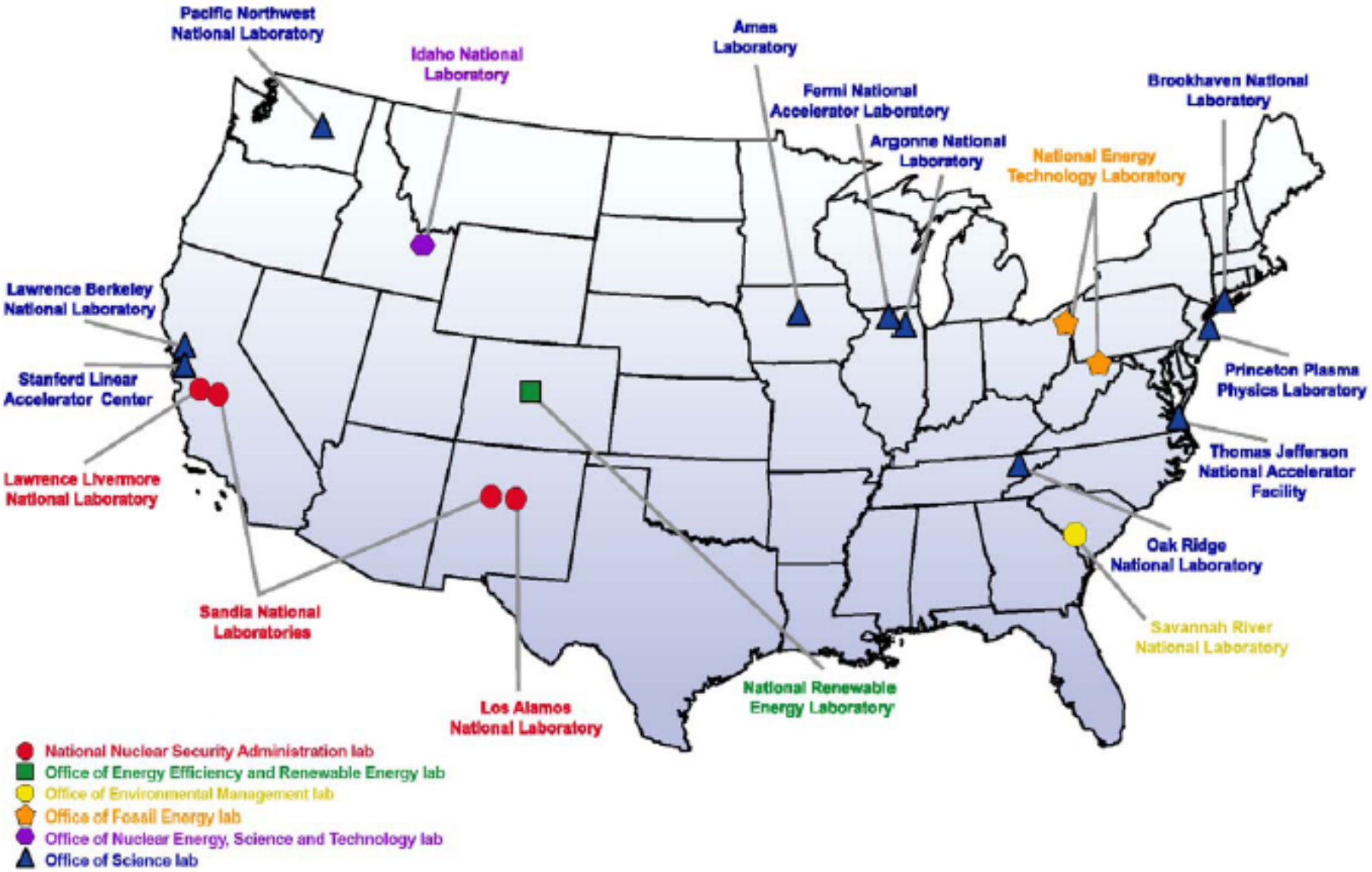
Challenges
- Enhance Public Acceptance
- Promote Supportive Public Policies
- Engage Key Stakeholders
- Address Wind System Siting Issues
- Facilitate Environmental Assessment

Solutions
- Wind Powering America Program (www.windpoweringamerica.gov)
- Interagency Collaboratives
- Targeted Outreach (tribal, utility)
- Facilitation of stakeholder dialog (environmental and siting issues)
- Federal Collaboration – Radar, F&W



The Program builds state-local wind stakeholder networks and engages key decision-makers to promote wind development.

Department of Energy National Laboratories



Financial assistance (http://www.dsireusa.org)

- **Renewable Electricity Production Tax Credit (PTC)**
  - **Incentive Type:** Corporate Tax Credit
  - **Amount:** 2.1¢/kWh for wind
  - **Summary:** The federal Renewable Electricity Production Tax Credit (PTC) is a per-kilowatt-hour tax credit for electricity generated by qualified energy resources and sold by the taxpayer to an unrelated person during the taxable year.
  - **In-Service Deadline:** December 31, 2009

Financial assistance (http://www.dsireusa.org)

- **USDA Rural Energy for America Program (REAP)**
  - **Incentive Type:** Federal Grant Program
  - **Amount:** Varies
  - **Max. Limit:** 25% of project cost
  - **Summary:** The REAP promotes energy efficiency and renewable energy for agricultural producers and rural small businesses through the use of (1) grants and loan guarantees for energy efficiency improvements and renewable energy systems, and (2) grants for energy audits and renewable energy development assistance.

Financial assistance (http://www.dsireusa.org)

- **Clean Renewable Energy Bonds (CREBs)**
  - **Incentive Type:** Federal Loan Program
  - **Amount:** Varies
  - **Summary:** Clean renewable energy bonds (CREBs) can be used by certain entities -- primarily in the public sector -- to finance renewable energy projects. The list of qualifying technologies is generally the same as that used for the federal renewable energy production tax credit. CREBs may be issued by electric cooperatives, government entities (states, cities, counties, territories, Indian tribal governments, or any political subdivision thereof), and certain lenders. The advantage of CREBs is that they are issued – theoretically – with a 0% interest rate.* The borrower pays back only the principal of the bond, and the bondholder receives federal tax credits in lieu of the traditional bond interest.

    **In practice, for a variety of reasons bond issuers typically must issue the bonds at a discount or make supplemental interest payments in order to find a buyer.*

Center for Energy and Environmental Sustainability

JAMES MADISON UNIVERSITY

- Energy profile in Virginia
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- Federal perspective and activities
- ***State perspective and activities***
- Efforts in Virginia to facilitate wind power development

Virginia Energy Plan (2007)

http://www.dmme.virginia.gov/vaenergyplan.shtml

"Governor Kaine is pleased to announce the release of Virginia's Energy Plan - a ten-year comprehensive Energy Plan geared to implement the Commonwealth's energy policy providing a clear path to protect the public health, safety, and welfare for all Virginians."

The plan establishes 4 primary goals for Virginia:

1. Increase energy independence, with an emphasis on conservation and clean fuel technologies, by:
   a. reducing the rate of growth of energy use by 40 percent. This will reverse the projected growth in per capita energy use and result in a nearly level per capita energy use per year.
   b. increasing Virginia's indigenous energy production by 20 percent.
2. Expand consumer energy education to overcome barriers to implementing energy-efficiency and conservation actions.
3. Reduce greenhouse gas emissions by 30 percent by 2025, bringing emissions back to 2000 levels.
4. Capitalize on economic development opportunities through business expansion and increased research and development in areas of strength, including alternate transportation fuels, nuclear technology, coastal energy production, and carbon capture and storage.

Executive Order No. 48 (2007)

http://www.governor.virginia.gov/initiatives/ExecutiveOrders/2007/EO_48.cfm

By the power vested in me by Article V of the Constitution of Virginia, and Section 2.2-103 of the Code of Virginia, and subject always to my continuing and ultimate authority and responsibility to act in such matters, I hereby direct the Governor's Secretaries and all executive branch agencies and institutions to reduce energy consumption and costs in state government operations in the executive branch. I also set forth a process for coordinating energy policy development within the executive branch.

- Impacts **Agency Energy Management**
- Establishes **State Agency and Institutions Energy Savings Goal**
- Affects **New and Renovated State-Owned Facilities and Leased Facilities**
- Addresses **Transportation Energy Use**
- Impacts Acquisition of State **Government Equipment and Supplies**
- Appoints **Senior Advisor for Energy Policy and Energy Policy Advisory Council**

HB 1994 Renewable portfolio standard program; establish goal for investor-owned incumbent electric utility (2009)

Summary as introduced: **Renewable portfolio standard program.** Establishes a goal for investor-owned incumbent electric utilities to have 15 percent of their total electric energy sales in the base year be from renewable energy sources in calendar year 2025. Currently, such a utility may participate in the voluntary renewable energy portfolio standard program if it demonstrates that it has a reasonable expectation of achieving 12 percent of its base year electric energy sales from certain renewable energy sources during calendar year 2022. A participating utility that meets the specified percentage goals is eligible for performance incentives that increase the fair combined rate of return on common equity and provide an enhanced rate of return on costs associated with the construction of renewable energy generation facilities.

Patron: Bulova

HB 2155 Electric utility service; net energy metering (2009)

Summary as introduced: **Net energy metering.** Requires an electric utility that purchases excess electricity generated by an eligible customer-generator under the net energy metering program pay for such electric power at a rate that is at least equal to the retail tariff rate that the customer-generator is charged for the electricity it buys from the utility. The maximum generation capacity for a nonresidential customer-generator is increased from 500 kilowatts to two megawatts. The measure also requires the State Corporation Commission to establish a program that will allow a customer with multiple, separately billed facilities located within a utility's service territory, one or more of which are eligible customer-generators, to aggregate the electricity consumption and generation of its participating facilities.

Patron: Toscano

SB 1347 Small Wind Energy Projects; DEQ to develop procedure permitting construction and operation thereof (2009)

Summary as introduced: **Wind energy development.** Exempts wind energy projects with a rated capacity of less than 100 megawatts that will be operated or constructed by a nonutility generator from provisions that require State Corporation Commission (SCC) approval. The Department of Environmental Quality (DEQ) is designated as the lead agency for issuing permits for such projects. Limits are imposed on the duration and financial obligations of the developer with respect to monitoring the effect of the project on birds and other wildlife. Any SCC proceeding involving an application for a certificate, permit, or approval required for the construction or operation by a public utility of a wind power facility is required to be completed within nine months following the utility's submission of a complete application. The measure establishes an investment tax credit whereby a taxpayer is allowed a credit against income taxes equal to 35 percent of the cost of constructing, purchasing, or leasing wind turbines and towers. The credit may be claimed over a five-year period. The amount of income tax credits in any taxable year shall not exceed 50 percent of the tax liability otherwise due, and a taxpayer is ineligible to claim a credit of more than $500,000 in any year. Finally the measure declares that wind turbines and towers are tangible personal property used primarily for the purpose of abating or preventing pollution of the atmosphere and waters of the Commonwealth and exempts 80 percent of their value from state and local taxation.

Patrons: Wagner and Norment

SB 1349 Mid-Atlantic Offshore Wind Energy Infrastructure Development Compact (2009)

Summary as passed: **Mid-Atlantic Offshore Wind Energy Infrastructure Development Compact.** Establishes the Mid-Atlantic Offshore Wind Energy Infrastructure Development Compact. Under the bill, the party states to the compact will be Virginia, Delaware, Maryland, New Jersey, and New York. The purposes of the compact are to (i) study, develop, and promote coordinated research and planning of the design, construction, utility interconnection, financing, and operation of offshore wind energy infrastructure and operations directly adjacent to the shores of the party states, (ii) coordinate federal, state, and local government efforts, and (iii) seek funding. The compact provides for a board with five representatives from each party state, three of whom are to be appointed by the Governor, one by the Speaker of the House, and one by the Senate. The measure takes effect upon enactment by Virginia and three of the other named states.

Patrons: Wagner and Cuccinelli

SB 1350 Marine Resources Commission; authority to lease subaqueous lands for generating electrical energy (2009)

Summary as passed: **Marine Resources Commission; offshore renewable resources.** Provides the Marine Resources Commission with the authority to lease subaqueous lands for the purpose of generating electrical energy from wave or tidal action, currents, offshore winds, or thermal or salinity gradients and transmit energy from such sources to shore and requires that any leases require a royalty. All royalties collected will be appropriated to the Virginia Coastal Energy Research Consortium. The Marine Resources Commission is also directed to (i) identify 100 acres suitable for use by the Virginia Coastal Energy Research Consortium as a research site, and (ii) determine whether sufficient and appropriate subaqueous lands exist to support a commercial offshore wind farm and, if such land exists, offer it for development in a lease auction.

Patron: Wagner

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James Madison University – Department of Integrated Science and Technology

- JMU–ISAT is the lead institution of higher education in Virginia in terms of
  - delivering qualified graduates to public and private sector jobs/careers involving wind power;
  - supporting the programmatic goals of the *Virginia Department of Mines, Minerals, and Energy – Energy Division* as pertain to wind power;
  - supporting the programmatic goals of the *U.S. Department of Energy – Wind Powering America.*

Sponsored Research and Development

- Since 2002, JMU has been awarded $1,575,428 to engage in research essential to the development and deployment of wind power in Virginia and the U.S.
  - all funded efforts involve undergraduate students
  - half of all ISAT graduates who engage in wind-related senior projects enter the wind industry
- JMU developed and continues to manage the *Virginia State-Based Anemometer Loan Program*

State-Based Anemometer Loan Program

SBALP

Virginia State-Based Anemometer Loan Program

- Home
- Program
- History
- Equipment
- Application
- Contract
- FAQ's
- Contact Info
- Links
- Wind Data
- Photo Gallery
- News Archive

Mission

The Virginia State-Based Anemometer Loan Program is designed to empower landowners by generating their interest in wind energy through the borrowing of meteorlogical towers and encouraging wind development.

James Madison University will now be accepting applications to participate in the State-Based Anemometer Loan Program (SBALP). SBALP is designed to spur the development of wind power in the state of Virginia by helping potential wind turbine users quantify their wind resource. Applications are currently being accepted. To participate in the program fill out an application and mail it to the address indicated.

Installation completed in Floyd County, Virginia. January 10, 2003.

Announcements (Updated 2/14/08)

The Virginia State-Based Anemometer Loan Program based at James Madison University was established in 2001 and has served more than 30 sites throughout the Commonwealth since then. In 2007, the program was temporarily halted to allow time for equipment upgrades and program assessment. The Virginia SBALP will resume operation, with updated mission and protocols, in Spring 2008.

Featured Photo (Delaplane, VA (Oct. 2003)

Wind News in the Region

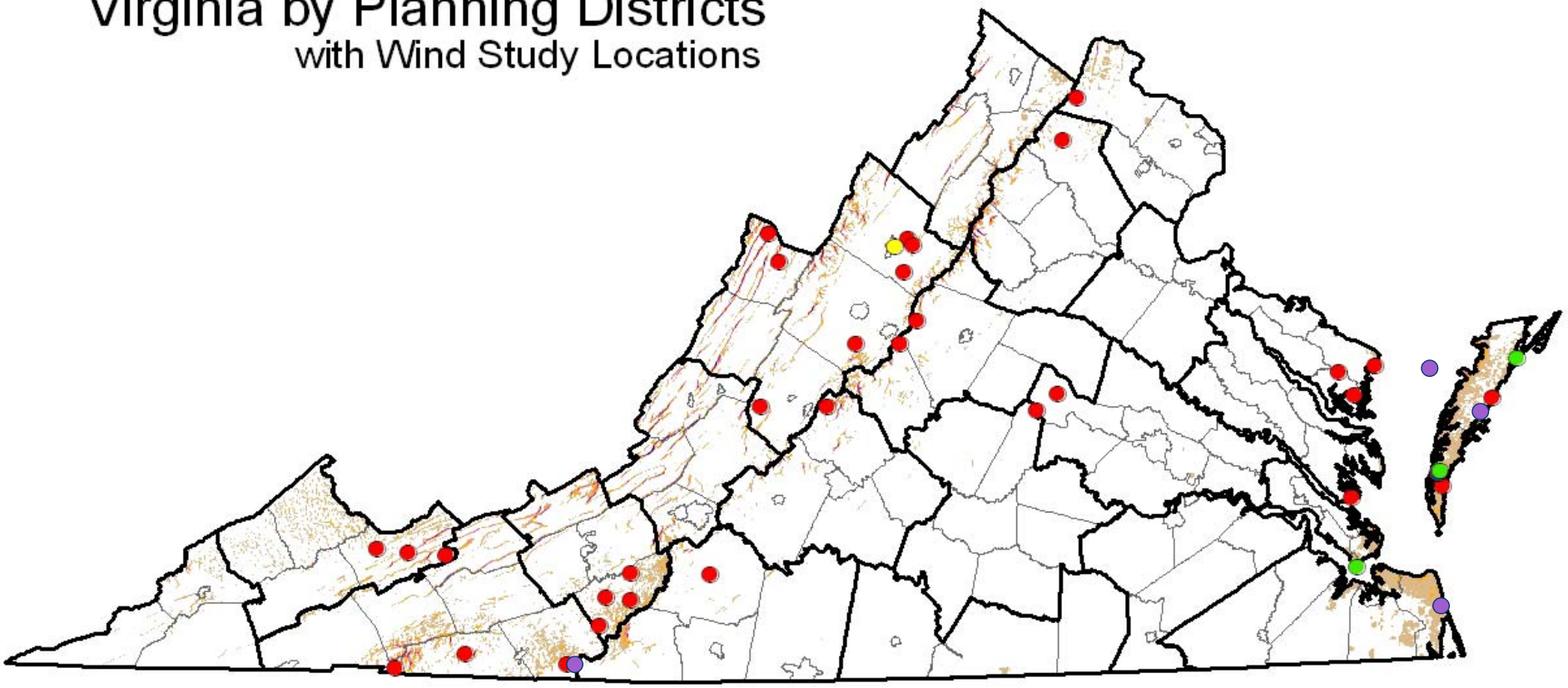
An Energetic Agenda, Cooperative Living (May 1st, 2009)

U.S. to clear way for offshore wind farms,

State-Based Anemometer Loan Program

State-Based Anemometer Loan Program

Virginia by Planning Districts
with Wind Study Locations



Legend

- District Outline
- County Outline
- SBALP 20-m Sites
- SBALP 50-m Sites
- Tall Tower Sites
- CISAT Turbine
- **Current and Planned Sites**

Wind Class

- 0
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- 2
- 3
- 4
- 5
- 6
- 7

N
W E
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0 35 70 140 Miles

Virginia Wind Energy Collaborative

JAMES MADISON UNIVERSITY.

Virginia Wind Energy Collaborative

- About Us
- Fact Sheets & Presentations
- Maps
- Outreach and Education
- Services Offered
- Learn About Wind
- Landscape Classification System (LCS) for Virginia
- Archives
- Join Our Mailing List
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- Home

Virginia Wind Energy Collaborative

The Virginia Wind Energy Collaborative (VWEC) was established to educate the public and inform decision-makers about wind power development in Virginia, in support of the Commonwealth's need for reliable and affordable energy, environmental quality, and economic development.

Mountaineer Wind Energy Center (Don Giecek, December 2004)

The Virginia Wind Energy Collaborative supports the balanced development of wind-derived energy in Virginia by providing information and analyses relevant to utility-scale, community-based, and smaller-scale applications. VWEC also provides a forum for collaboration among stakeholders and organizations interested in the benefits and opportunities associated with wind power development in the Commonwealth.

Current Events

- Dissecting Wind Powering America's 20% Vision Webinar
- AWEA Transmission Workshop, Mar. 17-18th, 2009
- 2008 Pennsylvania Wind Energy Symposium
- Governor's Commission on Climate Change
- AWEA Offshore Event, Sept. 9th-10th

Featured Photo

Wind News in the Region

Virginia Wind Energy Collaborative

- Conduct education and outreach throughout the Commonwealth
- Develop and disseminate fact sheets, guidebooks, tools and resources
- Conduct workshops and training sessions
- Organize and host statewide symposia
- Identify and engage key stakeholders
- Conduct analyses
  - residential and commercial
  - Wallops Flight Facility
  - Oceana/Dam Neck
  - Tangier Island
- Coordinate with regional and national organizations


Small Wind Electric Systems
A Virginia
Consumer's Guide
U.S. Department of Energy
Energy Efficiency and Renewable Energy

Virginia Coastal Energy Research Consortium

Virginia Coastal Energy Research Consortium

Home | About VCERC | Research | Board Members | Symposium | News | Education | Outreach | Related Links |

University Partners

- Old Dominion University
- Virginia Institute of Marine Science
- Virginia Tech Advanced Research Institute
- James Madison University
- Norfolk State University
- Virginia Commonwealth University
- University of Virginia
- Hampton University

Government Partners

- Hampton Roads Clean Cities Coalition
- Hampton Roads Sanitation District - Virginia Initiative Plant
- Hampton Roads Technology Council
- Virginia Department of Mines, Minerals & Energy
- VA DEQ Coastal Zone Management Program
- Virginia Marine Resources Commission

Industry Partners

- Science Applications International Corporation
- Virginia Manufacturers Association
- Virginia Maritime Association

VCERC was created by the VA legislature
(July 1st 2007-June 30th 2008). Since Jul
Virginian knowledge base to assist the Co
VCERC's ongoing efforts impact three key
improving the environment; and economic

Specifically, VCERC provides the research
of renewable energy by using algal biomas
removes pollutants from Chesapeake Bay,
production technology, and avoids utilizin
fuel. Project expansion in algal biofuels an
and lowering fuel prices in Virginia.

The VA General Assembly set out key energy policy statements and objectives. In ref

- Facilitate development of energy sources that are less polluting of the Commo and global warming
- Foster research and development of alternative energy sources that are compet
- Develop energy resources and facilities that do not impose a disproportionately
- Increase VA's reliance on agricultural-based ethanol and biodiesel from crops gr
- Ensure that energy generation and delivery systems are located in places that natural resources, and that are as near as possible to compatible development

The Consortium is governed by a board which consists of fourteen members - w
government and industry partners. The Consortium is located at Old Dominion Universi

Virginia Coastal Energy Research Consortium
Created by 2006 General Assembly to Bring Together Universities, State Agencies, and Industry

Virginia Coastal Energy Research Consortium

Virginia Tech

Mechanical, electrical, materials, civil, and ocean engineering

Washington, DC area presence

Old Dominion University

Physical, chemical, & geological ocean sciences

Virginia Institute of Marine Science — VIMS

Biological ocean sciences

James Madison University

Wind energy engineering

Renewable energy curriculum development

NSU Norfolk State University

High-tech workforce training

Entrepreneurship development

Non-University VCERC Directors

DMME Virginia Department of Mines Minerals and Energy

Integration of marine renewables into Virginia Energy Plan

Virginia Marine Resources Commission

Ensuring compatibility with other marine uses and coastal resources

Virginia Manufacturers Association — VMA

Identification of manufacturing job creation opportunities and industry benefits of long-term, price-stable energy supply

Hampton Roads Maritime Association, Incorporated 1920

Identification of waterfront development opportunities

Three Additional Universities and Two New Industry Representatives Added in 2007

Virginia Coastal Energy Research Consortium

Rice Center for Environmental Life Sciences expertise on natural algal blooms

Integration of GIS tool into Coastal GEMS

Virginia Coast Reserve Long-Term Ecological Research Project

Chemical Engineering Department -- fuels testing and characterization

Research and development of alternative marine biofuels and bioproducts

Non-University VCERC Directors

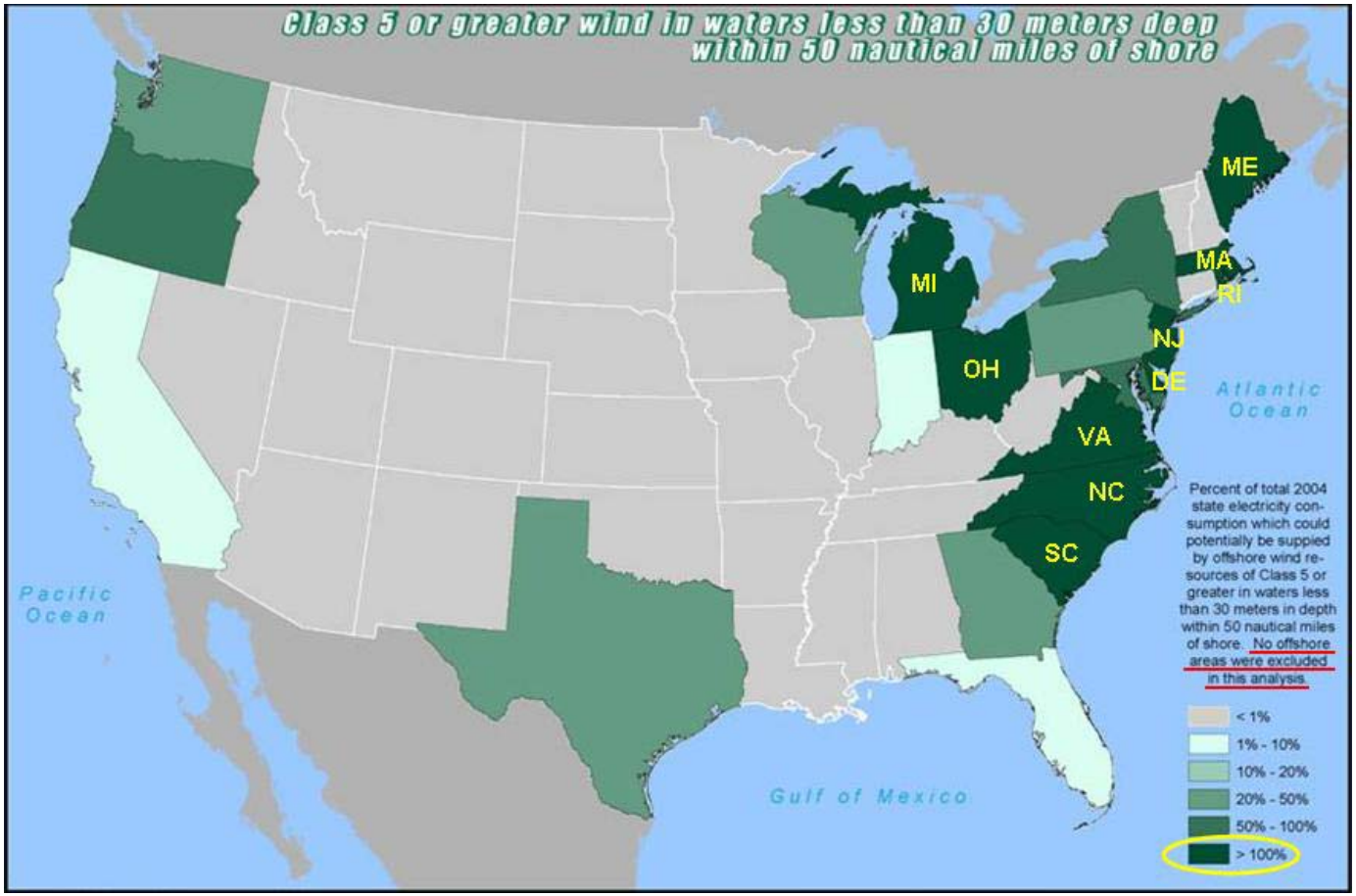
HAMPTON ROADS TECHNOLOGY COUNCIL

Interface with local high-tech industry, including advanced manufacturing, sensors, and control systems

Clean Cities VIRGINIA

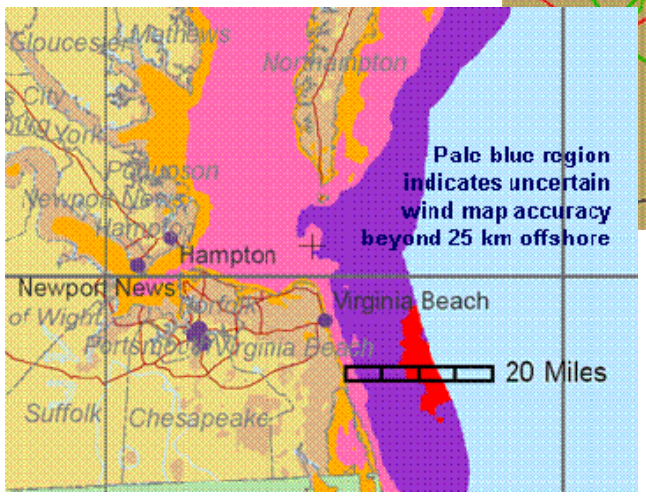
Virginia Clean Cities and the Hampton Roads Clean Cities Coalition identify regional transportation needs and opportunities for fuels from algae and integration of offshore wind with plug-in hybrid electric vehicles

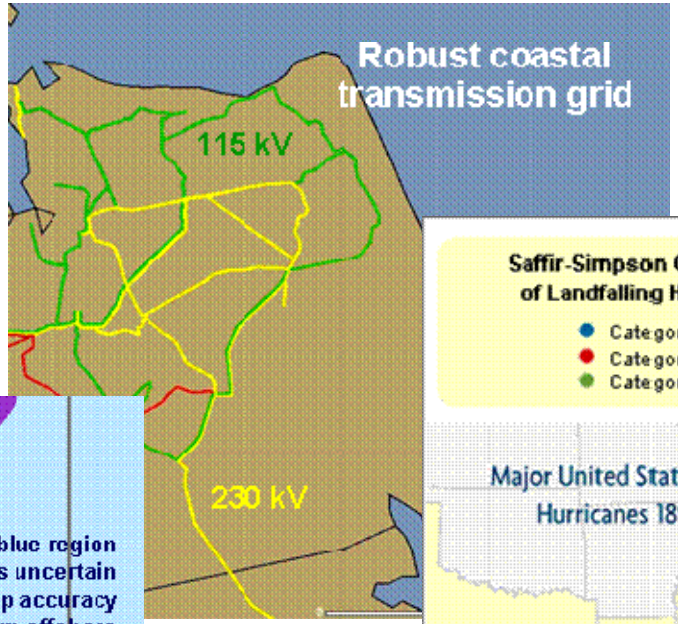
Virginia is One of Ten States with Shallow-Water Resource Base Comparable to Demand



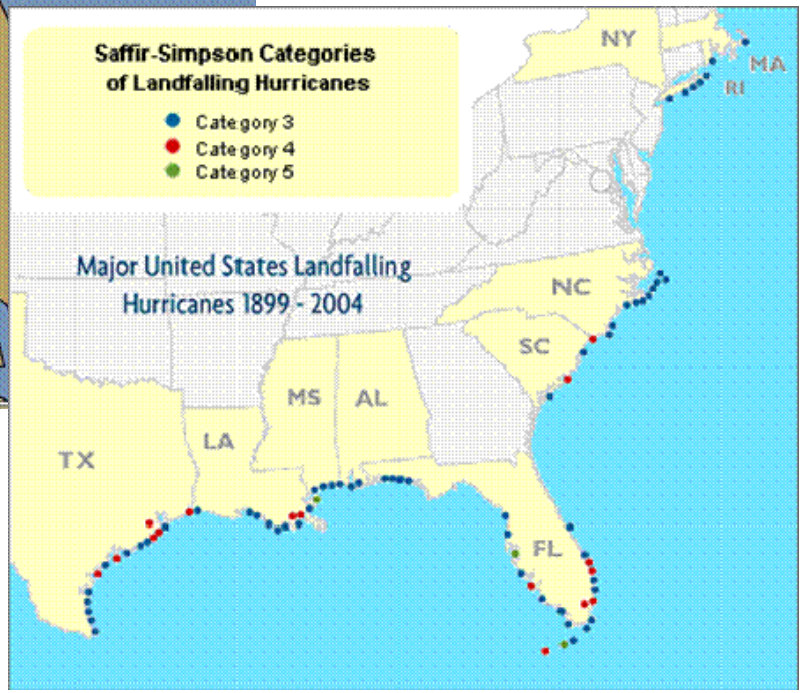
Hampton Roads Area has Unique Features Favorable for Offshore Wind Power Development

Class 6 (▭) wind energy resource located within 10-15 miles (16-24 km) of shoreline and close to major, growing centers of power demand

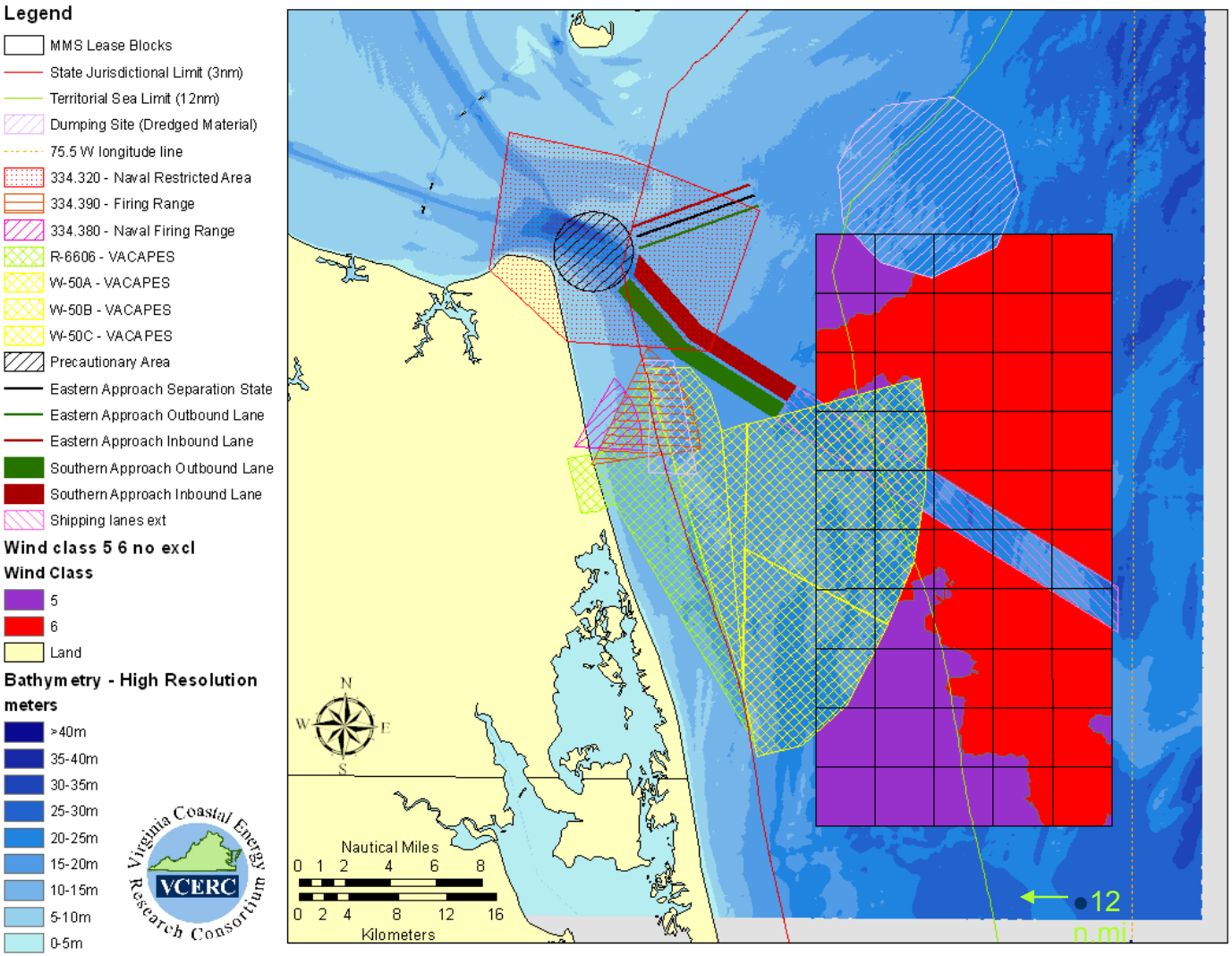




Minimal probability of major hurricane strike (Categories 3 through 5)



Class 6 Winds Beyond the Visual Horizon Could Be a Major Electricity Source for Virginia



- Total available area of Class 6 beyond 12 n.mi. could support 3,680 MW of wind capacity.
- With an average annual capacity factor of 40%, this could generate 12.9 million MWh per year.
- This is about 1/3 of what coal-fired power plants now generate in VA, or slightly more than half of what nuclear plants now produce.

An Outlook and Overview for Wind Power in the U.S. and Virginia

Jonathan J. Miles, Ph.D.
Professor, Department of Integrated Science and Technology
James Madison University

Virginia Wind Energy Collaborative
Virginia Coastal Energy Research Consortium

22 July 2009